RESULTS AND DISCUSSION

4- RESULTS AND DISCUSSIONS

1-Effect of foliar application of Magnesium,Iron, Manganese and Boron on vegetative growth and chemical analysis:

1-1- Effect on vegetative growth:

1-1-1-Number of leaves / Plant

A- Magnesium:

Data in Table (1,2) showed that the number of leaves per plant was significantly increased due to all levels of Mg which sprayed in the first season but in the second season, the medium level (125ppm) produced the maximum number of leaves per plant and the low level (100 ppm) gave the next result in this concern. But the high level of Mg (150 ppm) gave the least number of leaves per plant as compared with control plants. The rate of decreased reached to 7.27% than the control plants. In this concern could be showed that the medium level of Mg fertilizer (125ppm) significant increase leaf numbers / plant in both seasons, followed by low level (100 ppm) of Mg which attained 16.3 and 8.73 % or 22.3 and 13.12 % over control plants in the first and second seasons, respectively. **Attala et al. (1997)** on (leconte) pear trees which fertilized by magnesium at (30 , 60 , 90 ,120 g\tree) of chelated and sulphate sources indicated that the level of 120 g/tree (chelated or sulphate) gave the highest increment in number of new shoot in compared with control.

The element of Magnesium is very important for higher plants, reported that the insertion of magnesium into prophyrin structure as the first step of chlorophyll biosymthesis is catalyzed by the magnesium – chelatase. Magnesium also has an essential function as a bridging element for the aggregation of ribosome subunits (**cammarano et al. 1972**), a process that is necessary for protein synthesis. Magnesium is also required for RNA polymerases and hence for the formation of RNA in the nucleus. This latter role might be related to both bridging between individual DNA strands and neutraliqation of the acid proteins of the muclear matrix (**wanderlich, 1978**).

B-Iron:

Iron treatments attained highly significant increase of the leaf numbers / plant comparing with untreated plants (control) and all other treatments in the first season and second one. These effects were parallel to remarkable increase in Fe concentrations, they gave 17.81 %, 25.91 % and 27.78 % or 17.0 %, 25.59% and 45.62 % over the control plants in the first and second seasons, respectively, Table (1.2). On ***Dahlia pinnata*****, L. Mohamed (1992)** She reported that using Fe at 100 or 150 ppm improving the number of leaves.

The results could be attributed to the role of fe in plants . using fe at a specific concentrations played an important role in the leaf growth, cell number per unit area or number of chloroplasts per cell than on the size of the chloroplasts and protein content per chloroplast. Iron is required for protein synthesis and the number of ribosomes. **Marschner (1995).**

C- Manganese:

Data in Table (1.2) showed that the use of the three levels of Mn led to significant increase in the number of leaves / plant comparing with control application. Mn at 100 ppm (Medium level) gave the maximum number of leaves per plant, while Mn at 125 ppm (the high level) gave the next result but Mn at 75 ppm (the low level) produced the third number of leave per plant. On the other hand untreated plants gave the least number of leaves per plant. **Pareek et al. (1984)** stated that, spraying ***Cymbopogon martinii*** plants with Mn produced the highest number of branches per plant.

Mn was essential in numerous of physiological processes such as enzymatic reactions concerned with carbohydrate metabolism, phosphoryltons and citric acid cycle (**Mc Elory and Nason, 1984**). Also it activated the enzyme sucrose synthesis in the leaves **(patil and Jaski , 1975)**

D- Boron

As it could be seen from data in Table (1.2) all different concentrations produced highly significant increase of number of leaves per plant as comparing with untreated plants in the first and second seasons.

On the other side B at 50 ppm (low level) gave the best result in this concern. It increased the number of leaves by 32.06 and 42.36 % over the control plants in the first and second seasons, respectively. In this respect, could be showing the highest concentration of B (100 ppm) gave the minimum value for this character comparing with other concentrations (50 or 75 ppm) in this experiment. These results were harmony with those obtained by **Nandi and chatterjee (1991)** on ***Digitalis lanata*** ، Ehrh.) and (***D.purpurea***،L.) reported that، feeding with foliar application of mineral nutrients ،particularly Mg، Fe and B with concentration of (1 and 10 ppm) with 30 ml nutrient solution through leaves during morning hours in five installments was reduced the linear growth in all the treatments with the exception of B at l0ppm only which increased the same.

Concerning the effects of nutrient elements (Mg, Fe, Mn, B), regardless the different concentrations data in Table (3) and Fig. (1) show that iron gave the maximum number of leaves per plant in both seasons as 46.36, 57.72 leaves per plant, respectively. On the other hand Boron gave the next result in this concern, as 45.89, 56.37 leaves / plant in the first season and second one. While the control plants produced the minimum number of leaves per plant in both seasons. (37.43, 40.44 leaves / plant), respectively. Statistical analysis showed significant differences among the elements during the two seasons. Since B plays an important role in cell wall structure and plasticity **(Loomis and Durst, 1992, Hu and Brown, 1994)**, B deficiency limits the expansion or elongation of newly initiated leaves.

4- RESULTS AND DISCUSSIONS

1-Effect of foliar application of Magnesium,Iron, Manganese and Boron on vegetative growth and chemical analysis:

1-1- Effect on vegetative growth:

1-1-1-Number of leaves / Plant

A- Magnesium:

Data in Table (1,2) showed that the number of leaves per plant was significantly increased due to all levels of Mg which sprayed in the first season but in the second season, the medium level (125ppm) produced the maximum number of leaves per plant and the low level (100 ppm) gave the next result in this concern. But the high level of Mg (150 ppm) gave the least number of leaves per plant as compared with control plants. The rate of decreased reached to 7.27% than the control plants. In this concern could be showed that the medium level of Mg fertilizer (125ppm) significant increase leaf numbers / plant in both seasons, followed by low level (100 ppm) of Mg which attained 16.3 and 8.73 % or 22.3 and 13.12 % over control plants in the first and second seasons, respectively. **Attala et al. (1997)** on (leconte) pear trees which fertilized by magnesium at (30 , 60 , 90 ,120 g\tree) of chelated and sulphate sources indicated that the level of 120 g/tree (chelated or sulphate) gave the highest increment in number of new shoot in compared with control.

The element of Magnesium is very important for higher plants, reported that the insertion of magnesium into prophyrin structure as the first step of chlorophyll biosymthesis is catalyzed by the magnesium – chelatase. Magnesium also has an essential function as a bridging element for the aggregation of ribosome subunits (**cammarano et al. 1972**), a process that is necessary for protein synthesis. Magnesium is also required for RNA polymerases and hence for the formation of RNA in the nucleus. This latter role might be related to both bridging between individual DNA strands and neutraliqation of the acid proteins of the muclear matrix (**wanderlich, 1978**).

B-Iron:

Iron treatments attained highly significant increase of the leaf numbers / plant comparing with untreated plants (control) and all other treatments in the first season and second one. These effects were parallel to remarkable increase in Fe concentrations, they gave 17.81 %, 25.91 % and 27.78 % or 17.0 %, 25.59% and 45.62 % over the control plants in the first and second seasons, respectively, Table (1.2). On ***Dahlia pinnata*, L. Mohamed (1992)** She reported that using Fe at 100 or 150 ppm improving the number of leaves.

The results could be attributed to the role of fe in plants . using fe at a specific concentrations played an important role in the leaf growth, cell number per unit area or number of chloroplasts per cell than on the size of the chloroplasts and protein content per chloroplast. Iron is required for protein synthesis and the number of ribosomes. **Marschner (1995).**

C- Manganese:

Data in Table (1.2) showed that the use of the three levels of Mn led to significant increase in the number of leaves / plant comparing with control application. Mn at 100 ppm (Medium level) gave the maximum number of leaves per plant, while Mn at 125 ppm (the high level) gave the next result but Mn at 75 ppm (the low level) produced the third number of leave per plant. On the other hand untreated plants gave the least number of leaves per plant. **Pareek et al. (1984)** stated that, spraying ***Cymbopogon martinii*** plants with Mn produced the highest number of branches per plant.

Mn was essential in numerous of physiological processes such as enzymatic reactions concerned with carbohydrate metabolism, phosphoryltons and citric acid cycle (**Mc Elory and Nason, 1984**). Also it activated the enzyme sucrose synthesis in the leaves **(patil and Jaski , 1975)**

D- Boron

As it could be seen from data in Table (1.2) all different concentrations produced highly significant increase of number of leaves per plant as comparing with untreated plants in the first and second seasons.

On the other side B at 50 ppm (low level) gave the best result in this concern. It increased the number of leaves by 32.06 and 42.36 % over the control plants in the first and second seasons, respectively. In this respect, could be showing the highest concentration of B (100 ppm) gave the minimum value for this character comparing with other concentrations (50 or 75 ppm) in this experiment. These results were harmony with those obtained by **Nandi and chatterjee (1991)** on ***Digitalis lanata*** ، Ehrh.) and (***D.purpurea***،L.) reported that، feeding with foliar application of mineral nutrients ،particularly Mg، Fe and B with concentration of (1 and 10 ppm) with 30 ml nutrient solution through leaves during morning hours in five installments was reduced the linear growth in all the treatments with the exception of B at l0ppm only which increased the same.

Concerning the effects of nutrient elements (Mg, Fe, Mn, B), regardless the different concentrations data in Table (3) and Fig. (1) show that iron gave the maximum number of leaves per plant in both seasons as 46.36, 57.72 leaves per plant, respectively. On the other hand Boron gave the next result in this concern, as 45.89, 56.37 leaves / plant in the first season and second one. While the control plants produced the minimum number of leaves per plant in both seasons. (37.43, 40.44 leaves / plant), respectively. Statistical analysis showed significant differences among the elements during the two seasons. Since B plays an important role in cell wall structure and plasticity **(Loomis and Durst, 1992, Hu and Brown, 1994)**, B deficiency limits the expansion or elongation of newly initiated leaves.

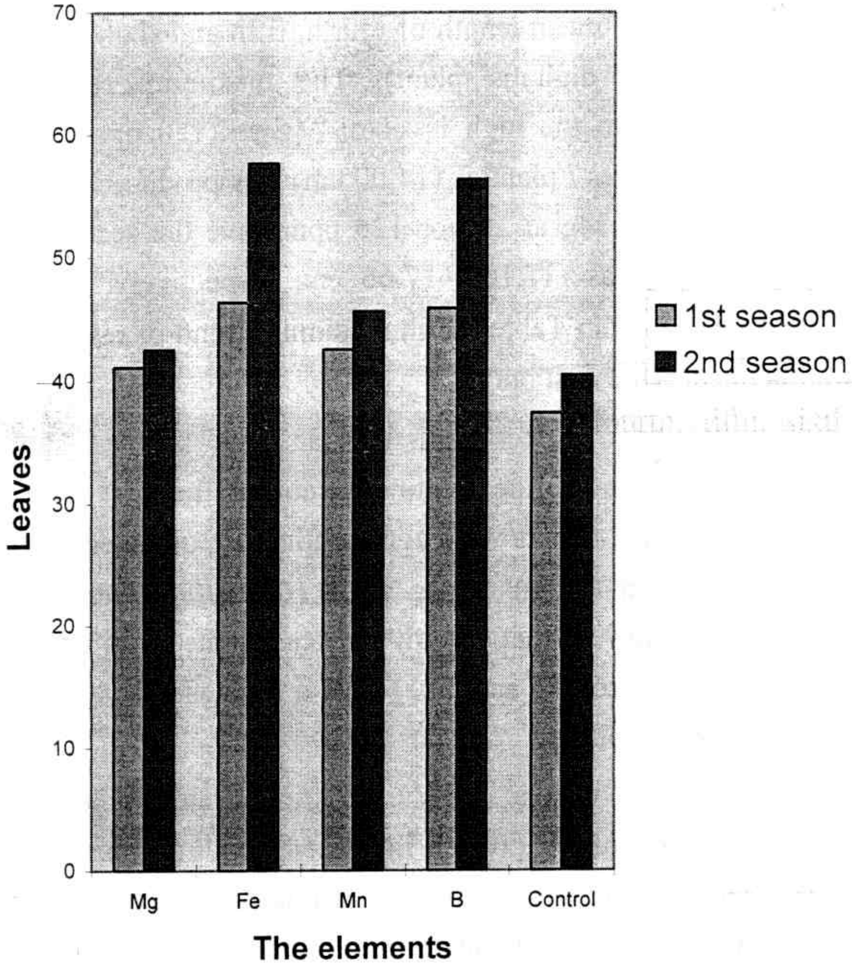

Fig.(1) Effect of magnesium, iron, manganese and boron on number of leaves / plant of (*Digitalis lanata* , Ehrh.)

1-1-2-Mean length of leaf:

A- Magnesium:

Data in Table (1) indicated that the main effect of magnesium as foliar fertilization has significant response in increasing the mean length of fourth, fifth and sixth leaves (from the base of digitalis plant). The maximum response was concomitant to the high level of Mg as (150 ppm). The least length of leaves / plant as (14.00 cm) was produced with control plants. While Mg at 100 or 125 ppm gave the second value in this concern as (17.100, 17.66 cm, respectively. Data in the second season in Table (2) show similar trend of results to those obtained in the first one.

In this respect statistical analysis showed significant differences among the treatments during the first and second seasons. These results were agree with those obtained by **Gohain and Barbora (2000)** on tea plant (***Camellia sinensis, L.*** (O) knutze). Showed that supplying tea plants with magnesium sources (chelate and sulphate) give a high yield of shoots (two leaves and a bud).

These results may be interpreted the suitable concentration of Mg, which increased building metabolites and resulted in more growth of leaves due to the activation of the anabolic processes in plant.

B- Iron:

Spraying Fe at the medium concentration produced more length of leaves as 17.0, 16.50cm in the first and second season, respectively as shown in Tables (1 and 2). While the lower concentration of Fe gave the next value in this concern. On the other hand the high level of Fe (150 ppm) produced the same results with control plants (14.267, 14.000 cm), respectively. It reflects significant increase in this character regard to the medium and lower concentrations of Fe over control plant.

These results are in accordance with those attained by **Abd El-Salam (1999)** studied the effect of iron at 50 and 100 ppm on the growth of fennel (***Foeniculum vulgar***) plants and found that, iron at 100 ppm was the most effective in increasing plant height than the other level (50ppm).

Iron is required For protein synthesis and the number of ribosomes the sites of protein synthesis derrieres in iron – deficient leaf cells (**lin and stocking, 1978).**

C- Manganese:

Data in Table (1) show that the length of ***Digitalis lanata*** leaves was significantly increased as all Mn concentrations in the first season. All levels of Mn gave the same range of leaf length as 16.167, 16.833, and 16.967 cm for 75, 100 and 125 ppm, respectively. The least length noticed with control plants. In the second season, the length of leaves as affected by foliar application of Mn it is clear from the data in Table (2) that there was an increase in this character due to Mn treatment especially with 100 or 125 ppm. The differences between treatments were significant. At this regard several investigators pointed to the enhancement effect of Mn on leaf length among them **Letchamo (1986** (on foxglove ***(Digitalis grandiflora*** ،Mill) indicated that, soaking the seeds in aqueous solution of manganese sulphate and a foliar spray at the rosette and technical maturity stages with aqueous solution of manganese sulphate improved plant performance and increased leaf size and the leaf yield.

The results could be attributed to the role of Mn in plants. Using Mn at a specific concentration played an important role in activation of many enzymes (**Hefler and Averill in 1987**) , also in photosynthesis and oxygen evolution (**Nable et al. , 1984**) .

D- Boron:

Tallest leaf was obtained from plants treated with boron At 100 ppm the mean length was 16.000 cm in the first season and 15.500 in the second season Tables (1 and 2) while B at 75 ppm produced the neat value as 14.667 cm and 14.057 cm in the first and second seasons, respectively.

On the other hand, the unfertilized plant with B showed significantly shortest leaf than the fertilized one in both seasons. Increasing length of leaves due to adding B had been recorded by many investigators among them **Nandi and chatterjee (1991)** on ***Digitalis lanata*** ،Ehrh.) and (***D.purpurea*** ،L.) reported that feeding with foliar application of mineral nutrients ، particularly Mg، Fe and B with concentrations of (1 and 10 ppm) with 30 ml nutrient solution through leaves during morning hours in five installments was reduced the linear growth in all the treatments with the exception of B at l0ppm only which increased the same. These results can be explained by that using a suitable concentration of B was essential for DNA synthesis and metabolism of carbohydrate and it was also essential to maintain the structural integrity of plant membrane (**Pilbeam and kirkby, 1983**).

Generally, the data of the two seasons in Table (3) and Fig. (2) indicate that using any elements (Mg, Mn, Fe, B) increasing the leaf length comparing with the untreated plant in both seasons.

However magnesium was of more effect in this concern, which increased by 25.8 % and 26.7% over the control in both seasons, respectively. While spraying the plants with Mn produced the next value in this concern in both seasons. At the mean time using Fe as fertilizer gave the third value in this character.

Significant differences could be seen between plant application with Mg, Fe, Mn, B and control in both seasons.

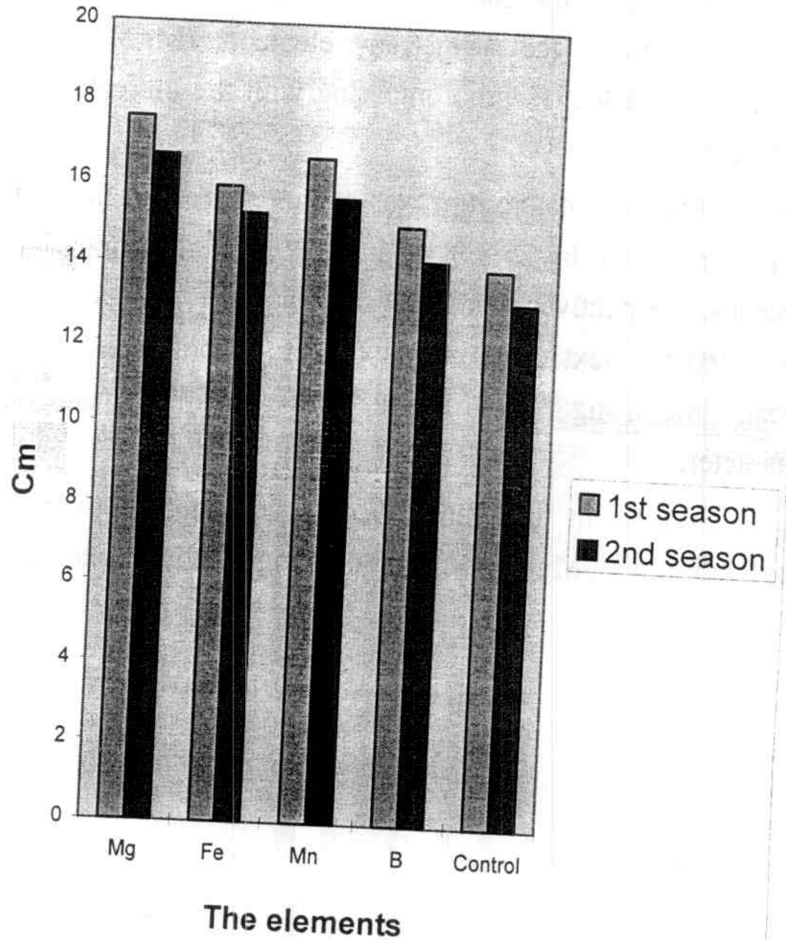

Fig.(2) Effect of magnesium, iron, manganese and boron on Mean length of leaf of (*Digitalis lanata* , Ehrh.)

1-1-3- Mean width of leaf (cm):

A- Magnesium:

Mean leaf width of (fourth, fifth and sixth leaves from the base of plant) increased significantly due to addition magnesium element during two seasons of the experiment as shown in Tables (1 and 2). This increase was Mg at 150 ppm. While Mg at 100 or 125 produced the same rate as 1.800, 1.833 cm in the first season. While in the second season Mg at 150 ppm gave the largest leaf width as 2.00 cm. But Mg at 125 ppm produced the next one on the other hand untreated produced the least leaf width in both seasons.The results are in harmony with **Gohain and Barbora (2000)** on tea plant (***Camellia sinensis, L.*** (O) knutze). Showed that supplying tea plants with magnesium sources (chelate and sulphate) give a high yield of shoots (two leaves and a bud).

The big leaf width resulted from magnesium treatment may be attributed to more of growth. The functions of magnesium in plants are mainly related to its capacity to interact with strongly nucleophilicligands through ionic bonding, and to act as a bridging element and or form complexes of different stability's. (**Marchner, 1995).**

B- Iron:

Mean width of leaves (fourth, fifth and sixth leaves from the base of plant) tabulated in Table (1) show that the mean width of leaves increased significantly with iron treatment than control plants. Also plants, received sprayed with 125 ppm were largest in this concern. While the plants received Fe at 100 or 150 ppm gave the next one. In the second season, Fe at 100 ppm gave the biggest width of leaves (fourth, fifth and sixth from the base of plant). While the Fe at 125 produced the next value in this concern. Table (2) the differences between treatments and control were significant in both seasons. The results came in harmony with those recorded by **Misra and Srivastava (1990)** using cuttings of ***Mentha arvensis*** cv. Ms-77 in a complete nutrient solution containing 0, 0.5, 2.8, 5.0 and 11.2 ppm Fe, stated that, number of tillers per plant were greatest at 0.5 ppm Fe. In the meantime, incrementing Fe supply caused an enhance in leaf area.

C- Manganese:

It is clear form the data in Table (1) the mean width of leaves (fourth, fifth, sixth from the base of plant) showed response of Mn fertilization in both seasons. All concentrations of Mn increased the width of leaves over the control plants. The most effective concentration of Mn was 125 ppm. The values recorded were 1.933, 1.988 cm in the first and second seasons, respectively. The results agree with those reported by **Letchamo (1986)** on foxglove ***(Digitalis grandiflora*** ،Mill) indicated that, soaking the seeds in aqueous solution of manganese sulphate and a foliar spray at the rosette and technical maturity stages with aqueous solution of manganese sulphate improved plant performance and increased leaf size and the leaf yield.

D- Boron:

All boron treatments significantly increased the mean width of (fourth, fifth and sixth from the base of plant) over untreated plants in both seasons as shown in Tables (1 and 2).

The data indicated the Boron at 100 ppm was greatly effective in both seasons. The mean width of leaves was 1.900, 1.973 cm in the first and second seasons, respectively. While Boron at 75 ppm produced the nest result in this concern.

These results are in agreement with those obtained by **Hu and brown (1994)** on tobacco indicated that boron plays an important role in cell wall structure and plasticity.

Regardless, the different between concentrations of four fertilizer elements (Mg, Fe, Mn, and B), using iron produced the best result in this concern, since the mean value was 1.922 cm. While Mg and Mn elements gave the next value in this respect as 1.856, 1.833 cm.

Control plant produced the least leaf width in both seasons Table (3) and Fig. (3).

The differences among elements and control were significant in both seasons. Fe plays an important role in the protein content because of a particularly high iron requirement of chloroplastic mRNA and rRNA **(spiller et. al. 1987).**

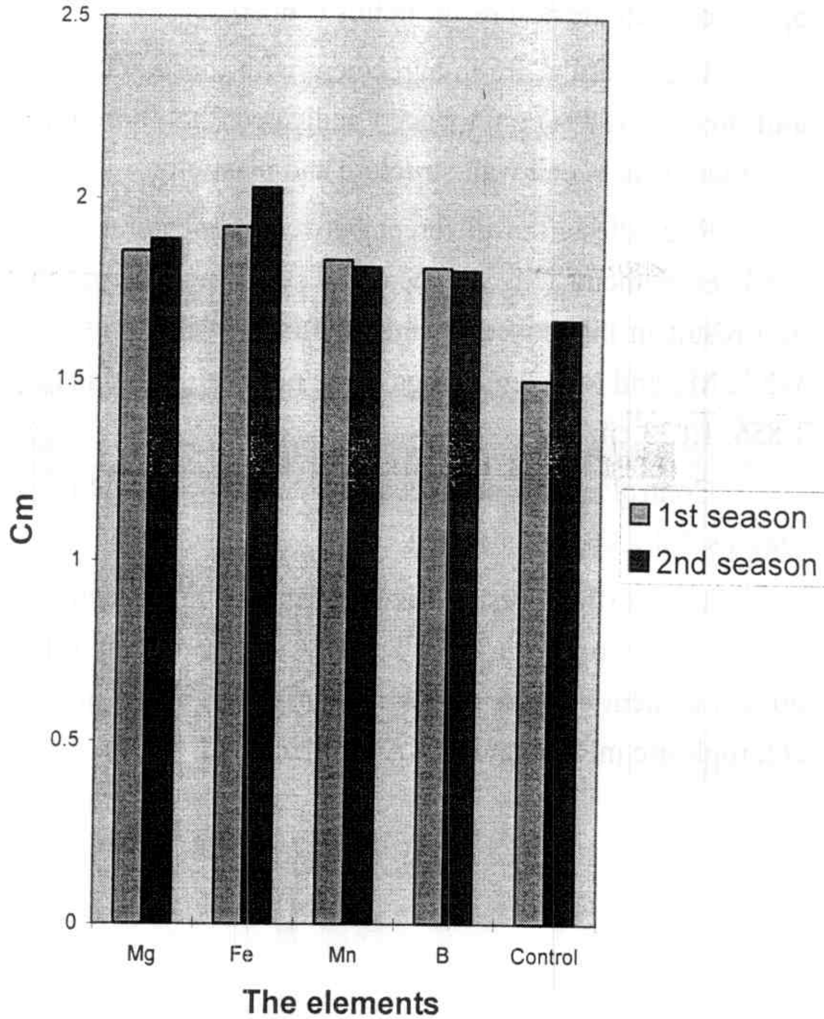

Fig.(3)Effect of magnesium, iron, manganese and boron on Mean width of leaf of (*Digitalis lanata* ,Ehrh.)

1-1-4- Fresh weigh of leaves/plant in (g):

A- Magnesium:

Data presented in Tables (1 and 2) show that the application of magnesium at 150 ppm was more effective in increasing the fresh weight of leaves per plant significantly over control in both seasons. While Mg at 125 ppm gave the next values in this respect in the first and second one. According to **Gohain and Barbora (2000)** on tea plant (***Camellia sinensis, L.*** (O) knutze). Showed that supplying tea plants with magnesium sources (chelate and sulphate) gave a high yield of shoots (two leaves and a bud).

B- Iron:

It is clear from the results presented in Table (1 and 2) for the first and second seasons that Fe at 125 ppm gave the heaviest fresh weight of leaves per plant in both seasons as 51.600, 55.573 g in the first and second and, respectively. On the other side, Fe at 100 ppm gave the next result in this respect in both seasons. The differences between all concentration of Fe and control were significant in both seasons. **Mohamed (1992)** obtained the same results on ***Dahlia pinnata. L.***

C- Manganese:

Results of the first season in Tables (1,2) show that the fresh weight of leaves per plant were greatly affected by different concentrations of Mn. The heaviest fresh weight of leaves as 51.300, 56.730 g was produced by Mn at 125 ppm in the first and second season, respectively. While Mn at 100 ppm gave the next values in this concern as 50.633, 51.280 g in the first and second one respectively. Also the untreated plants gave the least fresh weight of leaves per plant. In both seasons Table (1and 2). These results are in accordance with those attained by **Letchamo (1986)** on foxglove (***Digitalis grandiflora*** ‹Mill) indicated that, soaking the seeds in aqueous solution of manganese sulphate and a foliar spray at the rosette and technical maturity stages with aqueous solution of manganese sulphate improved plant performance and increased leaf size and the leaf yield.

D- Boron:

Table (1 and 2) presented the effect of different concentration of boron on the mean fresh weight of leaves/ plant. It is clear that Boron at 50 ppm (lower concentration) was more effective to increasing the fresh weight of leaves per plant in both seasons as 50.900, 52.710 g respectively. Also all differences were significant in both seasons. The obtained results are in agreement with some works as **Huang et al. (1996)** on ***Brassica nabus ‹cv.Eureka*** (oilseed rabe) reported that the most actively growing leaf decreases in response to a decrease or interruption in the external boron supply.

Generally it appears that the data of Fresh weight of leaves per plant in Table (3) and Fig. (4) show high increase due to all element fertilization over the control plants. Spraying iron and manganese produced the heaviest fresh weight of leaves plant as 50.51, 50.39, respectively in the first season. At the mean time addition of magnesium and boron gave the next value in this concern as 49.48 and 49.51 g / plant.

Data in the second season shown in the same Table appears similar trend of results to those obtained in the first one.

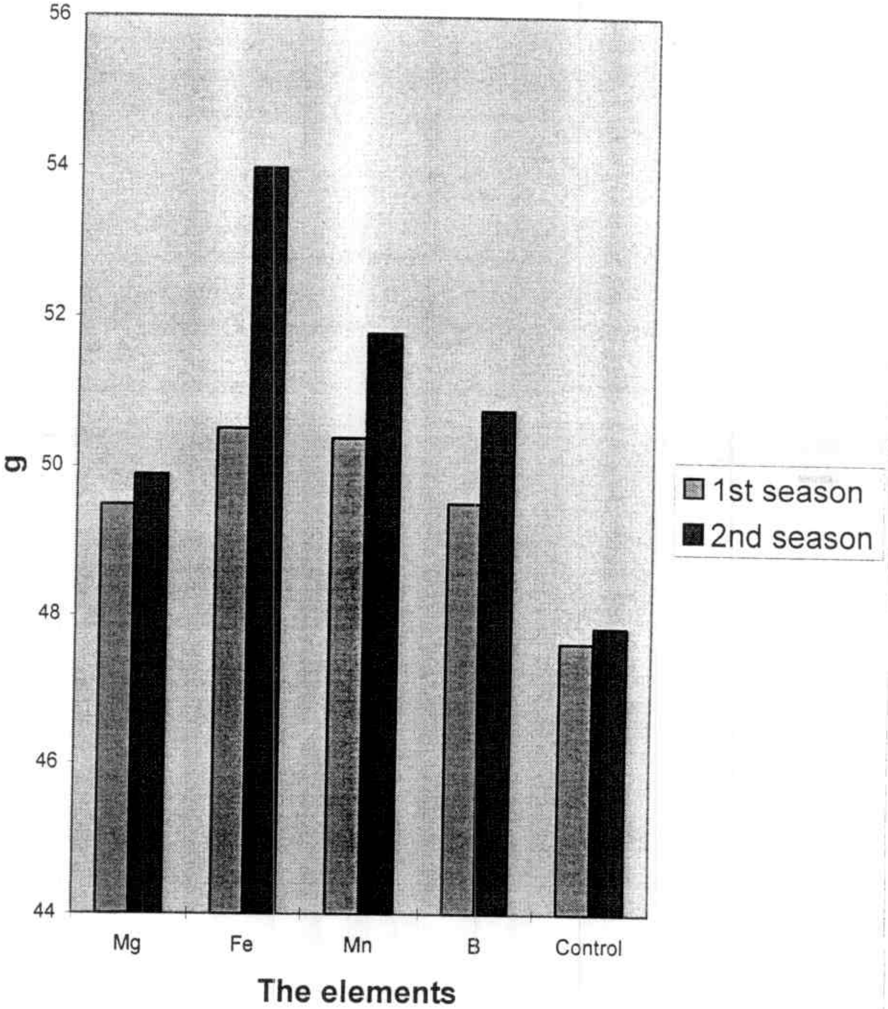

Fig.(4)Effect of magnesium, iron, manganese and boron on fresh weightof leaves/plant of (*Digitalis lanata* , Ehrh.)

1-1-5- Dry weigh of leaves/plant in (g):

A- Magnesium:

Data presented in Tables (1 and 2) show that the application of magnesium at 150 ppm was more effective in increasing the dry weight of leaves per plant significantly over control in both seasons. While Mg at 125 ppm gave the next values in this respect in the first and second one according to **Basak and Dravid (1998)** on wheat in green house which given 0-60 kg Mg/ha indicated that the addition of Mg increased dry matter yield.

B- Iron:

It is clear from the results presented in Table (1.2) for the first and second seasons show that Fe at 125 ppm gave the heaviest dry weight of leaves per plant in both seasons as 13.610, 14.963 g in the first and second seasons, respectively. On the other side, Fe at 100 ppm gave the next result in this respect in both seasons. The differences between all concentration of Fe and control were significant in both seasons. **Zaied (1984)** on soapwort (***Saponaria officinalis)*** showed that, there was a progressive increased in plant height with spraying plants with Fe at 50 ppm. The branches number per plant as well as dry matter of different plant organs and whole plant increased with Fe spraying at concentration of 50 ppm.

C- Manganese:

Results of the first season in Tables (1 and 2) show that the dry weight of leaves per plant were greatly affected by different concentrations of Mn. The heaviest dry weight of leaves as 12.977, 13.783 g was produced by Mn at 125 ppm in the first and second season, respectively. While Mn at 100 ppm gave the next values in this concern as 12.677, 13.303 g in the first and second one respectively. Also the untreated plants gave the least dry weight of leaves per plant. In both seasons Tables (1 and 2). These results are in accordance with these attained by **Zaied (1984)** on soapwort (***Saponaria officinalis)*** plants mentioned that, spraying plants with Mn at 50 ppm caused the highest dry weight of plant organs. In the same time, the number of branches per plant was increased in plants sprayed with manganese.

D- Boron:

Tables (1 and 2) presented the effect of different concentrations of boron on the mean dry weight of leaves/ plant. It is clear that Boron at 50 ppm (lower concentration) was more effective to increasing the dry weight of leaves per plant in both seasons as 13.204, 13.990 g respectively. Also all differences were significant in both seasons. The obtained results are in agreement with some works as **Huang et al. (1996)** on ***Brassica nabus ،cv.Eureka*** (oilseed rabe) reported that the most actively growing leaf decreases in response to a decrease or interruption in the external boron supply.

Generally it appears that the data of dry weight of leaves per plant in Table (3) and Fig. (4) show high increase due to all element fertilization over the control plants. Spraying iron and manganese produced the heaviest dry weight of leaves per plant as 13.200, 12.936 respectively in the first season. At the mean time addition of magnesium and boron gave the next value in this concern as 12.620 and 12.840 g / plant.

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

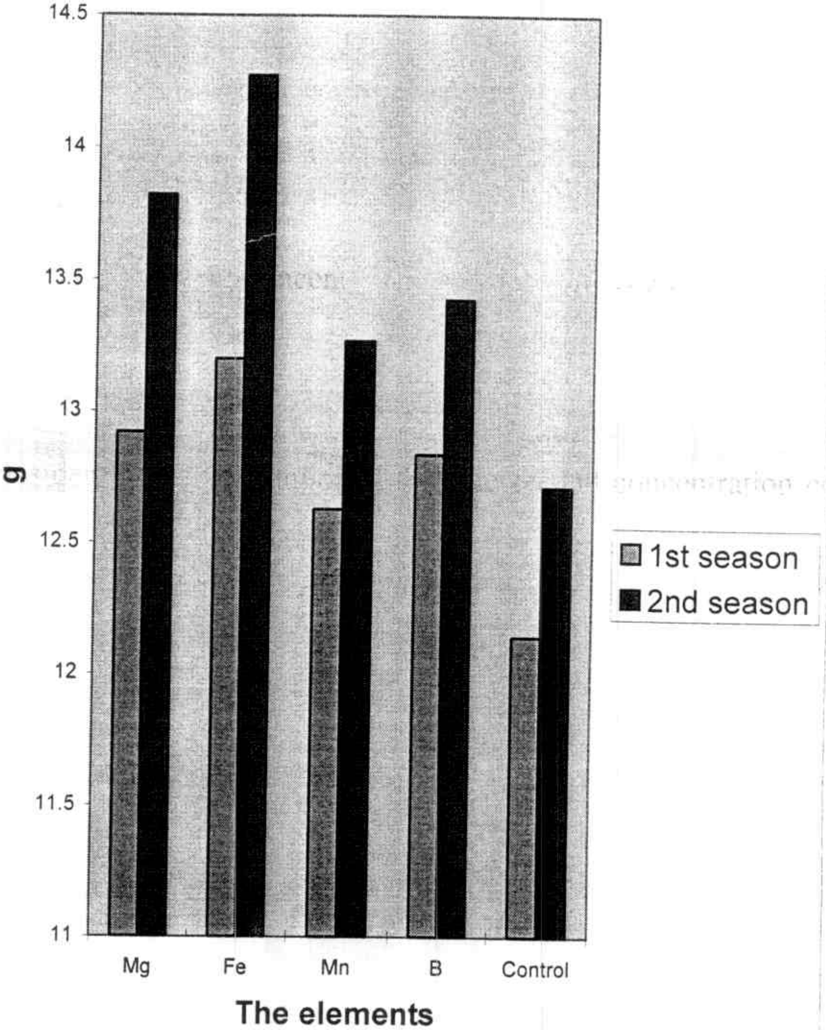

Fig.(5) Effect of magnesium, iron, manganese and boron on dry weight of leaves/plant of (*Digitalis lanata* , Ehrh.)

Table (1) Effect of magnesium and some microelements and concentration on vegetative growth of digitalis plant (*Digitalis lanata* Ehrh).

Treatments / Characters		No. of leaves/plant	Mean length of leaf (cm)	Mean width of leaf (cm)	Fresh weight of leaves (g)/plant	Dry weight of leaves(g)/plant
Element	Concentration	First season 1997/1998				
Mg	100	40.700	17.100	1.800	47.467	12.377
	125	43.533	17.667	1.833	49.600	12.813
	150	39.133	18.100	1.933	51.367	13.277
Fe	100	44.100	16.433	1.900	50.533	13.177
	125	47.133	17.000	2.000	51.400	13.610
	150	47.833	14.267	1.867	49.600	12.810
Mn	75	39.733	16.167	1.767	49.233	12.443
	100	44.167	16.833	1.800	50.633	12.777
	125	43.933	16.967	1.933	51.300	12.977
B	50	49.430	14.433	1.733	50.900	13.204
	75	44.730	14.667	1.800	48.967	12.760
	100	43.500	16.000	1.900	48.667	12.547
Control	0	37.433	14.000	1.500	47.633	12.143
L.S.D. at 5%		2.0372	2.011	0.1754	1.394	0.5315

Table (2) Effect of magnesium and some microelements and concentration on vegetative growth of digitalis plant (*Digitalis lanata* Ehrh).

Treatments / Characters		No. of leaves/plant	Mean length of leaf (cm)	Mean width of leaf (cm)	Fresh weight of leaves (g)/ plant	Dry weight of leaves (g)/ plant
Element	**Concentration**	**Second season 1997/1998**				
Mg	**100**	46.090	15.723	1.733	48.857	13.407
	125	49.830	16.433	1.933	50.287	13.667
	150	37.780	17.883	2.000	50.533	14.187
Fe	**100**	47.670	15.500	2.200	53.877	14.177
	125	51.170	16.500	2.067	55.573	14.963
	150	59.330	13.777	1.823	52.513	13.677
Mn	**75**	44.870	14.390	1.710	47.303	12.723
	100	46.670	16.167	1.800	51.280	13.503
	125	45.470	16.433	1.933	56.730	13.983
B	**50**	58.000	13.000	1.677	52.710	13.990
	75	50.000	14.057	1.800	49.947	13.370
	100	46.110	15.500	1.933	49.607	12.923
Control	**0**	40.743	13.167	1.667	47.847	12.717
L.S.D. at 5%		2.755	1.972	0.167	2.457	0.712

Table (3) The average effect of magnesium , iron ,manganese and boron on vegetative growth of digitalis plant (*Digitalis lanata* Ehrh).

Characters / Treatments	No. of leaves/plant	Mean length of leaf (cm)	Mean width of leaf (cm)	Fresh weight of leaves (g)/ plant	Dry weight of leaves (g)/ plant
Element	First season 1997/1998				
Mg	41.120	17.62	1.856	49.48	12.620
Fe	46.360	15.90	1.922	50.51	13.200
Mn	42.610	16.66	1.833	50.39	12.936
B	45.890	15.03	1.811	49.51	12.840
Control	37.430	14.00	1.500	47.63	12.143
L.S.D. at 5%	1.369	0.98	0.101	0.805	0.307
Element	Second season 1998/1999				
Mg	42.567	16.68	1.889	49.892	13.620
Fe	57.722	15.26	2.030	53.988	14.272
Mn	45.667	15.66	1.814	51.783	13.970
B	56.370	14.19	1.803	50.754	13.428
Control	40.443	13.17	1.667	47.847	12.717
L.S.D. at 5%	1.591	1.39	0.097	1.419	0.411

1-2- Effect on chemical analysis:

1-2-1- Effect on mineral content:

1-2-1-1- Nitrogen content (%):

The data in Table (4) clearly show that all the applied treatments led to significant increase of nitrogen percentage in comparison with control. With regard to the effect of magnesium application, it could be observed that the concentrations resulted in a gradual increase with the increase of the concentration applied the highest value was that of the 150 ppm concentration which reached to 1.988 %.On the other hand iron application followed another trend where nitrogen recorded increment in the second concentration (125 ppm) followed by a decrement in the third one, the high value was 2.149 %. With regard to boron application such treatments exhibited similar trend as that obtained with magnesium application where a gradual increment in nitrogen percentages could be observed the third concentration (100 ppm) which recorded the highest value 2.202 %. In contrast to the previous, applied element manganese had a decreasing effect on nitrogen percentage where it decreased with increasing the concentration, the lowest value was that of the third concentration which recorded 1.848 %.

As general effect resulted from each treatment, it could be concluded from Table (8) the average value of the concentrations applied, that most treatments exhibited increment over control. Boron recorded the highest value in comparison with the control.

1-2-1-2 Phosphorus content (%):

From Table (4) it could be observed that the applied treatments resulted in an increase over the control in most cases the exception were found in the third concentration of manganese, the first and the third concentration of iron. With regard to magnesium treatments the results showed decrement in the second concentration in comparing with other concentration of magnesium, the highest value was that obtained in the first concentration at 100 ppm where the value reached 0.170%. Iron treatments showed slight increment in the second concentration followed by a decrease in the third one, the second concentration gave the highest value which reached 0.101%. It can be mentioned that the second concentration could be considered as optimum concentration. With regard to manganese application, such treatments had decreasing effect, where phosphorus was decreased by increasing the concentration applied. Concerning boron treatments, a decreasing effect could be observed in the second concentration followed by increase in the third concentration the highest value was that of the third concentration which reached to 0.212%. Concerning the significance, it appeared in the treatments of magnesium treatments; first concentration of iron; first and third concentrations of boron and first concentration of manganese respectively in comparison with control. In general effect of element application, it can be concluded from Table (8) that most treatments were increased significantly over control except of iron treatments which gave the lowest value in this concern.

1-2-1-3- potassium content (%):

The presented data in Table (4) showed that there were no significant differences between the applied treatments on potassium percentages in comparing with control, but such treatments gave an increase over control, that iron treatment at 125 ppm, boron at 75 ppm and iron at 150 ppm which gave the highest value of potassium percentages with 17.27, 14.55 and 10.73 % increase over control respectively. Magnesium concentrations showed a gradual decrease in potassium percentage with increasing with increasing magnesium concentration. With regard to manganese concentrations and the first and second concentrations of boron it could be concluded that these concentration reduced potassium percentage in comparing with control. Concerning the average data of potassium percentage Table (8) as by elements application, it can be noticed that iron and magnesium applications gave the highest value of this character which gave 12.36 and 4.00% increase over control respectively, in contrast with boron and manganese treatments which recorded the lowest value in this character in comparing with control.

1-2-1-4 Magnesium Content (%):

Regarding the data obtained in Table (4), it could be showed that such treatments increased significantly magnesium content in comparing with control. The highest value of magnesium content (%) was obtained by magnesium treatment at 100 ppm followed by the treatment of manganese at 75 ppm and magnesium at 125 ppm which gave 14.16, 12.56 and 12.10 % increase over control.

The lowest values obtained on magnesium content that usig the second and third concentration of manganese followed by boron concentration at 100 ppm which reached to 0.428, 0.438 and 0.396 % in comparing with control which reached to 0.438 %. As general effect of spraying the concerned element, it could be concluded from Table (8) that using foliar application of magnesium increased magnesium content (%) by 7.08 % increase over control, followed by the application of iron and boron respectively.

1-2-1-5- Iron content (ppm):

Data from Table (4) showed that there were a significant differences between the application treatments on iron content (ppm) concerning magnesium concentrations, both of the first and second concentration gave the highest values of iron content from magnesium treatments. Iron content was clear increased by increasing the concentration while boron concentration gave a contrary trend when iron content decreased by increasing boron concentrations. Manganese concentration showed another trend that the highest content of iron followed by the first one between other concentrations of manganese. Generally the highest value of iron content between different concentrations of all element applied that using iron at the third and second levels and the third level of magnesium which gave 174.92, 158.86 and 151.18 % increase over control respectively. With regard the average data in Table (8), it could be concluded that iron application increased the iron content followed by manganese treatment and boron treatment respectively.

1-2-1-6- Manganese content (ppm):

From Table (4) data showed that there were a significant differences between treatments on manganese content *in* comparison with control. With respect to highest value obtained between all concentrations of each elements that treatment with manganese at 125 ppm followed by the first concentration of manganese which equaled to the second concentration of boron and the second concentration of magnesium which gave 85.00, 70.00 and 45.00 % increase over control respectively. Each of magnesium, iron and manganese gave a gradual increase in manganese content by increasing the concentration level of such element. While increasing the boron concentration from the second to third concentration led to an decrement in this character. Average data in Table (8) indicated that boron application led to increment in manganese content followed by manganese and magnesium application, which gave 43.34, 43.00 and 36.67 % increase over control respectively.

1-2-1-7- Boron content (ppm):

Data recorded in Table (4) indicated that most treatments gave an increase over control with the exception of the first concentration of iron and manganese, which gave the lowest values under control. The second level of element concentration almost gave the same value of boron content in comparison with other levels of concentration, which almost reached to 23.00 ppm. The highest values were obtained by using magnesium at 125 ppm, magnesium at 150 ppm and boron at 100 ppm, which produced 73.74, 39.66 and 36.31 increase over control respectively. As general effect of folair application of the concerning elements on boron content (ppm), it could be considered from Table (8) that magnesium application gave the highest content of boron in leaves of digitals plant followed by manganese and boron applications which recorded 44.45, 12.47 and 10.80% increase over control respectively.

Table (4) Effect of magnesium, iron, manganese and boron concentrations on the mineral content of digitalis plant (*Digitalis lanata* Ehrh).

Treatments / Characters		N (%)	P (%)	K (%)	Mg (%)	Fe (ppm)	Mn (ppm)	B (ppm)
Element	Concentration (ppm)	season 1997/1998						
Mg	100	1.895	0.170	0.598	0.500	60.000	56.667	21.47
	125	1.881	0.149	0.569	0.491	52.500	51.667	22.10
	150	1.998	0.151	0.550	0.396	125.17	48.333	25.00
Fe	100	1.842	0.092	0.602	0.449	94.333	38.333	20.10
	125	2.149	0.101	0.645	0.489	129.00	38.333	23.00
	150	1.935	0.073	0.609	0.459	137.00	40.000	22.40
Mn	75	2.082	0.182	0.549	0.493	78.100	40.333	18.90
	100	1.915	0.108	0.510	0.404	91.333	45.000	22.90
	125	1.848	0.099	0.518	0.428	56.833	61.667	21.60
B	50	1.969	0.180	0.489	0.459	84.833	38.333	20.90
	75	2.041	0.125	0.630	0.476	78.333	49.667	23.30
	100	2.202	0.212	0.501	0.471	36.167	43.333	24.40
Control	0	1.788	0.100	0.550	0.438	49.833	33.333	17.90
L.S.D. at 5%		0.206	0.032	N.S	0.317	18.44	10.560	2.55

1-2-2-Effect on photosynthetic pigments:

1-2-2-1- chlorophyll A content (%):

The presented data in Table (5) indicated that there was a significant increase in chlorophyll A in most treatments in compared with control. The data showed that there was a gradual increase in chlorophyll A percentages by increasing the concentration level of applied treatments such as magnesium and manganese treatments. But boron treatment gave a contrary trend, which decreased chlorophyll A content with increasing concentration level. With respect to iron concentration the third concentration decreased chlorophyll a content in compared with other iron concentrations. Concerning the highest values were obtained by the application of boron at 50 ppm followed by iron at 125 ppm and magnesium at 125 ppm which produced 16.52, 12.31 and 9.17 % increase over control respectively. The average data in Table (8) revealed that iron application gave the highest value of chlorophyll A percentage followed by magnesium application in comparing with control.

1-2-2-2- chlorophyll B content (%):

All concentrations of all nutrient elements used for foliar spraying showed a significant effect on chlorophyll B content as comparing with control Table (5). The highest value of chlorophyll B were obtained by spraying with boron at 50 ppm followed by iron at 125 ppm and boron at 75 ppm which gave 36.59, 21.63 and 16.14 % increase over control respectively.With regard to magnesium and manganese treatments it could be concluded that there was a gradual increase in chlorophyll B content with increasing the concentration applied. In contrast increasing boron concentration led to a decrease in chlorophyll B content. While the lowest values of this character were recorded at the application of all manganese concentrations; the first and third concentrations of iron and the first concentration of magnesium. Data in Table (8) showed a general effect of different application of such elements on chlorophyll B content, it could be mentioned that boron and magnesium application produced gave the highest values, While iron and manganese gave the lowest values in comparing with control.

1-2-2-3- Carotenoids content (%):

Data in Table (5) revealed that there was a significant difference between treatments comparing with control on carotenoids content. All treatments led to an increment over control except the first concentration of iron and the second concentration of manganese. While the highest values of carotenoids were obtained by concentration of boron at 50ppm followed by iron at125ppm and magnesium at 125ppm which recorded 20.32,9.80and5.26 % increases over control respectively. Concerning the average data presented in Table (8), it could be considered that boron application recorded the highest carotenoids content as well as magnesium treatment. While iron and manganese applications gave the lowest carotinoids content in compared with control.

Table (5) Effect of magnesium ,iron,manganese and boron concentrations on photosynthetic pigments of digitalis plant (*Digitalis lanata* Ehrh).

Treatments / Characters		Chlorophyll A (%)	Chlorophyll B (%)	Carotenoids (%)
Element	Concentration (ppm)	season 1997/1998		
Mg	100	45.223	21.507	50.893
	125	50.211	23.856	53.089
	150	51.209	24.053	52.545
Fe	100	49.460	20.126	50.148
	125	51.860	25.385	55.379
	150	48.008	22.578	50.768
Mn	75	47.885	20.336	51.514
	100	42.337	21.263	50.047
	125	50.411	21.895	52.457
B	50	53.804	23.508	60.683
	75	43.416	24.240	51.190
	100	40.310	22.792	51.363
Control	0	46.175	20.871	50.435
L.S.D. at 5%		6.853	3.646	3.595

1-2-3- Total carbohydrates and Total glycoside content:

1-2-3-1- Total carbohydrates content (%):

From Table (6) it could be observed that there was a significant difference found between applied treatments and control on total carbohydrates content. All treatments led to an increment over control with the exception of the second and third concentrations of B treatment. The highest values were recorded from the application of Fe at125ppm followed by Fe at 150ppm and Mg at 125ppm, which recorded an increment with 37.46, 33.81and 23.17%, increases over control respectively. The average data presented in Table (8) revealed that there was a significant difference between the applied elements in comparison with control on total carbohydrates content. The highest values were recorded from the application with iron followed by Mg and Mn treatments, which gave 31.60, 19.37and10.73 %increases over control respectively.

1-2-3-2- Total glycoside content (%):

Data obtained from Table (6) indicated that that there was a significant difference between applied treatments and control on total glycoside content. The highest values were recorded by using Fe treatments with second and third concentrations and the first concentration of B, which produced 17.72, 16.92 and 17.10 %increment over control respectively. The presented data in Table (7) and Figures (6,7,8,9 and 10), revealed that the highest value digitoxin content was obtained from Fe treatment at 125ppm while the highest value of digoxin content was obtained by using Mn at 75ppm. As a general effect of the application treatments of such elements, it could be concluded that the highest total glycosides content was found by using B application followed by Fe and Mg applications, which recorded 16.48, 15.92 and 14.24 % increases over control respectively.

Table (6) Effect of magnesium, iron, manganese and boron concentrations on total carbohydrates and total glycosides contents of digitalis plant (*Digitalis lanata* Ehrh).

Treatments	Characters	Total carbohydrates (%)	Total glycosides (%)
Elements	Concentration (ppm)	season 1997/1998	
Mg	100	6.014	1.822
	125	6.523	1.832
	150	6.428	1.859
Fe	100	6.557	1.820
	125	7.280	1.893
	150	7.087	1.880
Mn	75	6.113	1.836
	100	6.025	1.817
	125	5.454	1.796
B	50	5.562	1.883
	75	5.963	1.872
	100	5.625	1.1863
Control	0	5.296	1.608
L.S.D. at 5%		1.076	0.018

Table (7): High Pressure liquid chromatography determination of main glycoside constituents of *Digitalis lanata* ‹Ehrh.

constituents Treatment	Digitoxin content(%)	Digoxin content(%)
Mg150	0.258	0.039
Fe125	0.520	0.250
Mn75	0.096	0.380
B50	0.056	0.340
control	0.096	0.310

Table (8): The average effect of magnesium, iron, manganese and boron on chemical analysis of digitalis plant (*Digitalis lanata* Ehrh).

Characters / Treatments	N (%)	P (%)	K (%)	Mg (%)	Fe (ppm)	Mn (ppm)	B (ppm)	Chloroph-yll A (%)	Chloroph-yll B (%)	Caroten-oids(%)	Total carbohydrates (%)	Total glycosids (%)
Element	season 1997/1998											
Mg	1.922	0.157	0.572	0.469	45.889	45.556	25.856	47.547	22.478	50.852	6.322	1.837
Fe	1.975	0.089	0.618	0.466	100.167	35.556	19.833	48.443	20.696	50.432	6.974	1.864
Mn	1.948	0.130	0.526	0.442	75.422	49.000	20.133	43.544	18.165	47.673	5.864	1.817
B	2.071	0.172	0.540	0.462	66.444	47.778	18.867	45.843	24.847	52.421	5.717	1.873
Control	1.788	0.100	0.550	0.438	49.833	33.333	17.900	46.175	20.871	50.435	5.296	1.608
L.S.D. at 5%	0.116	0.018	0.043	0.182	10.64	6.095	1.474	N.S	2.105	2.076	0.621	0.010

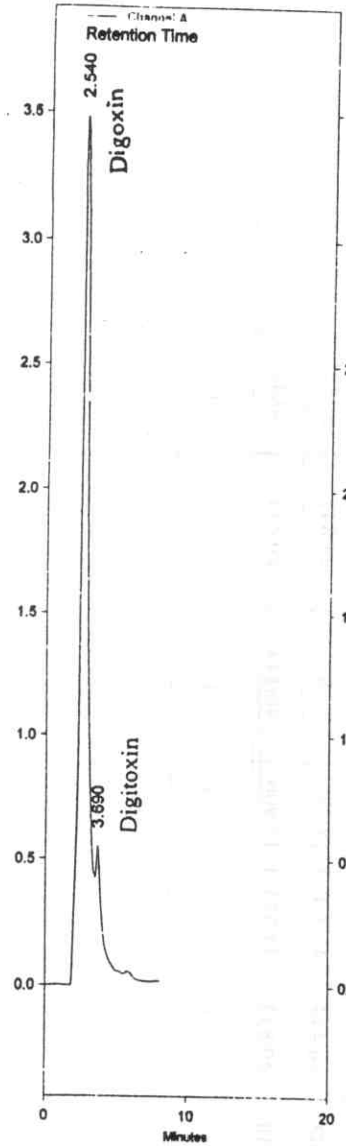

Fig (6): magnesium at 150 ppm

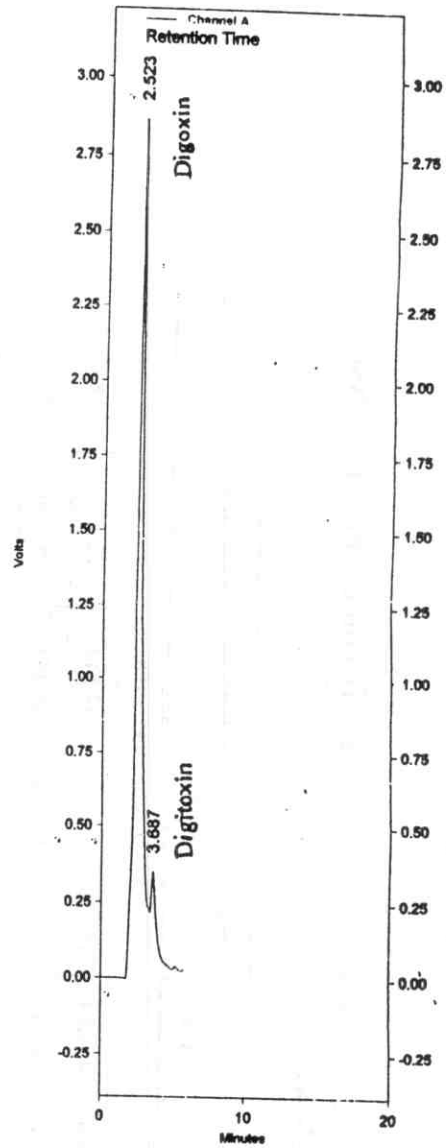

Fig (7): iron at 125 ppm

HPLC chromatogram of main glycoside of *Digitalis lanata* Ehrh. Plant.

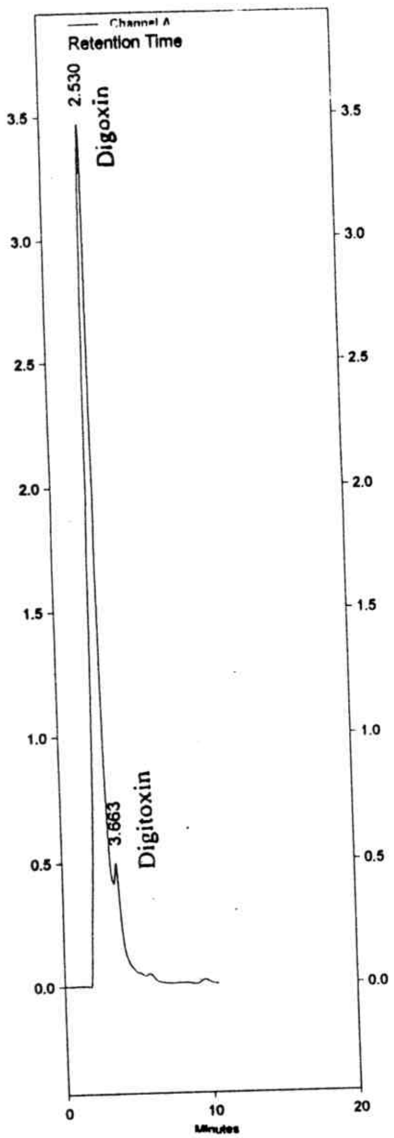

Fig (8): manganese at 75 ppm

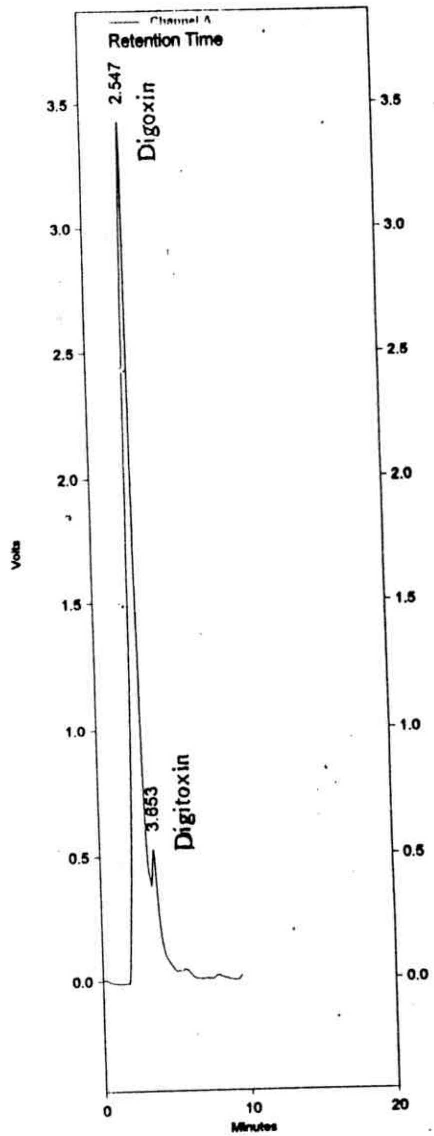

Fig (9): boron at 50 ppm

HPLC chromatogram of main glycoside of *Digitalis lanata*, Ehrh. Plant

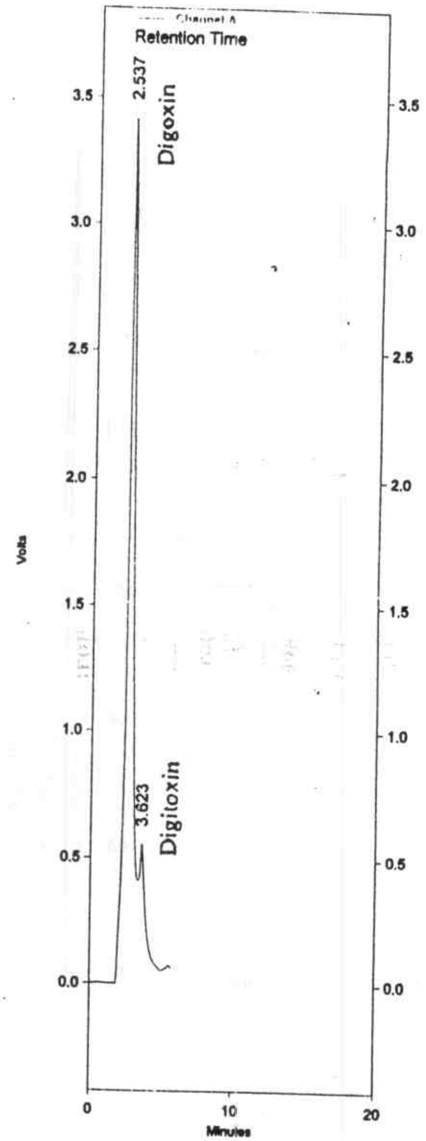

Fig (10): Control

HPLC chromatogram of main glycoside of *Digitalis lanata*, Ehrh. plant

2- Effect of irrigation intervals on vegetative growth and chemical analysis of digitalis plant (*Digitalis lanata Ehrh.*):

2-1-Effect on vegetative growth

2-1-1-Number of leaves/plant:

Data in Table (9) of the first season (1997) obviously show that irrigation intervals had different effects on the number of leaves per plant. Irrigation every 14 days has a great effect on the mean number of leaves per plant. Leaves number in this case was 7.9%and 10.36 % more than irrigation every 7 days or 21 days respectively. The difference in this respect was significant in both seasons. Also in the second season, irrigation every 14 days gave the maximum number of leaves per plant as 54. 00 Lvs / plant. While the irrigation every 7 days produce the next value as 49.667 lvs. /Plant but irrigation every 21 days gave the least number of leaves per plant.

2-1-2-Mean length of leaves in (cm):

Results in Table (9) indicated that the different irrigation intervals were affected in this character. Irrigation every 14 days gave the longest mean length of the fourth fifth and sixth leaves from the base of plant. This treatment gave 18.367, 14.917 cm in the first and second seasons, respectively, while irrigation every 7 days and 21 days produced 15.933, 14.143 in the first season and 11.583, 11.167 in the second one, respectively. The differences between irrigation treatments studied on leaf length were significant in both seasons and the best leaf length was obtained with irrigation at 14 days in both seasons than other irrigation treatments.

2-1-3-Mean leaf width (cm):

Table (9) presented the effect of different irrigation treatments on the mean leaf width (the leaves of 4^{th}, 5^{th} and 6^{th} from the base of plant). It is clear that irrigation at 14 days intervals was significantly effective in increasing the mean leaf width as (1.963 and 1.820 cm) in the first and second seasons, respectively. The trend of result with irrigation at 7 days and 21 days intervals was nearly the same with seasons. In this respect irrigation at 7 days intervals gave 1.577 and 1.553 cm in the first and second seasons, respectively while irrigation at 21days produced 1.697 and 1.570 cm in the first and second one.

2-1-4-Fresh weight of leaves /plant (g):

Irrigation at 14 days intervals was effective in increasing the fresh weight of leaves per plant as 56.333 and 47.090g in the first and second seasons, respectively. On the other hand irrigation at 7 days intervals gave the next result in this concern as 52.333 and 45.593g in both seasons respectively while irrigation at 21 days gave the minimum fresh weight of leaves per plant in both seasons as 46.900 and 44.323g respectively.

Statistical analysis showed significant differences among the irrigation treatments during the two seasons, Table (9).

2-1-5-Dry weight of leaves/ plant in (g):

Irrigation at 14 days intervals was effective in increasing the fresh weight of leaves per plant as 18.567 and 14.800g in the first and second seasons, respectively. On the other hand irrigation at 7 days intervals gave the next result in this concern as 15.967 and 13.627g in both seasons respectively. While irrigation at 21 days gave the minimum fresh weight of leaves per plant in both seasons as 15.167 and 13.207g respectively. Statistical analysis showed significant differences among the irrigation treatments during the two seasons, Table (9).

Generally it appears that irrigation at 14 days intervals resulted in the highest increase in vegetative growth in both seasons. **Balbaa et al. (1971)** on (***Digitalis lanata*** *Ehrh.*) plants which irrigated at 5, 10 and 20 days intervals, they indicated that irrigation at 10 days intervals resulted in a significant increase in the vegetative growth of ***D. lanata*** plants, as manifested by the increase in total dry weight of plants, number of leaves per plant and dry weight of leaves per plant as compared to plants irrigated at 20 days intervals. However, there was no significant difference in the number of leaves per plant and dry weight of leaves per plant irrigated at 5 and at 10 days intervals.

These results may be interpreted that this range of irrigation was suitable with digitalis lanata under these conditions (soil and atmosphere) , which in turn, increased building metabolites and resulted in more growth due to the activation of the anabolic processes in plant , which were translocated from the leaves leading to more growth.

The role of water in increasing the growth may be explained by its role in photosynthesis it is confirmed by the study of **Hoare and Barrs (1974)** on the effect of different degrees of water stress, their data presented on plant responses in the terms of changes in leaf water potential transpiration photosynthesis, translocation and carbohydrate metabolism. They concluded that mesophyll resistance and stomatal resist with increasing stress and were associated with declining photosynthesis.

Table (9) Effect of irrigation intervals on vegetative growth of digitalis plant (*Digitalis lanata* Ehrh).

Characters Treatments	No. of leaves/plant	Mean length of leaf (cm)	Mean width of leaf (cm)	Fresh weight of leaves (g)/ plant	Dry weight of leaves (g)/plant
	First season 1997/1998				
7 days	52.417	15.933	1.577	52.333	15.967
14 days	56.557	18.367	1.963	56.333	18.567
21 days	51.250	14.143	1.697	46.900	15.167
L.S.D. at 5%	2.526	2.011	0.259	2.099	1.959
	Second season 1998/1999				
7 days	49.667	11.583	1.553	45.593	13.627
14 days	54.000	14.917	1.820	47.090	14.800
21 days	47.250	11.167	1.570	44.323	13.207
L.S.D. at 5%	2.584	2.019	0.203	2.122	1.087

2-2-Effect on chemical analysis:

2-2-1-Nitrogen(%) :

The data obtained in Table (10) shown that there was no significant deference between irrigation treatment studied, but showed that the higher content of N% was recorded with irrigation at 14 days followed by irrigation at 7 days treatment.

2-2-2-Phosphorus content (%):

Data obtained in Table (10) showed that there was no significant differences between the irrigation treatments, and showed that irrigation at 14 days recorded higher content of P% than other treatments.

2-2-3-Potassium content (%) :

Data in Table (10) showed that there was not significant difference between irrigation treatments, and showed that irrigation at 14 days gave the higher content of K% than other treatments .

2-2-4-Chlorophyll A content (%):

The obtained data in Table (10) indicated that there was significant effect between the irrigation treatments studied, and showed that irrigation at 14 days gave the higher content of chlorophyll A followed by irrigation at 7 days treatment .While the irrigation at 21 days intervals produced the least content of chlorophyll A.

2-2-5-Chlorophyll B content(%):

The obtained data in Table (10) indicated that there was significantly effect between the irrigation treatments studied, and showed that irrigation at 14 days gave the higher content of chlorophyll B followed by irrigation at 7 days treatment. At the mean time, the irrigation at 21 days gave the minimum content of chlorophyll B.

2-2-6-Carotenoids content (%):

Data in Table (10) indicating that there was significant difference between irrigation treatments studied, and showed that irrigation at 14 days gave the higher content of caroteneoids followed by irrigation at 7 days intervals. But irrigation at 21days gave the lower content of carotenoids.

2-2-7-Total carbohydrates content (%):

Data presented in Table (10) indicated that carbohydrates content were significantly affected by the different irrigation treatments studied, but the data showed that irrigation at 14 days resulted in higher content of the total percentage of carbohydrates than other irrigation treatments .

2-2-8-Total glycoside content (%):

Data obtained in Table (10) indicating that the percentage of total glycosides, calculated as digitoxin and referred to the weight of samples obtained from plants in the different treatments didn't show any significant difference, by any of irrigation treatments studied, but the irrigation at 14 days gave the best yield of percentage of total glycosides followed by the treatment of irrigation at 21 days.

Table (10) Effect of irrigation intervals on chemical analysis of digitalis plant (*Digitalis lanata* Ehrh.).

Characters / Treatments	N (%)	P (%)	K (%)	Chlorophyll (A) (%)	Chlorophyll (B) (%)	Carotenoids (%)	Carbohydrates (%)	Total glycosids(%)
Irrigation period	**The average of seasons 1997/1998 and 1998/1999.**							
7 days	1.909	0.161	0.519	33.749	14.548	39.488	2.994	1.786
14 days	1.912	0.174	0.589	35.568	17.655	40.236	4.374	1.834
21 days	1.822	0.103	0.472	31.554	12.678	32.901	3.784	1.799
L.S.D. at 5%	N.S	N.S	N.S	0.541	2.031	1.920	1.002	N.S