EFFECT OF SOIL TYPE AND FERTILIZATION TREATMENTS ON GROWTH AND CHEMICAL COMPOSITION OF SOME ORNAMENTAL SHRUBS I-*CESTRUM AURANTIACUM* (LINDLEY).

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ABSTRACT

This work was carried out at Antoniadis Garden, Horticultural Research Institute, Alexandria, Ministry of Agriculture, Alexandria, Egypt. during the two successive seasons of 2005/2006 and 2006/2007 to study the effect of some fertilization treatments on Cestrum aurantiacum transplants grown in pots contain sandy, clay and sandy clay (1:1 v/v) soils. The used fertilization treatments were control (without fertilization), a full dose of NPK, 1/2 dose of NPK + active dry yeast, 1/2 dose NPK + compost and compost + active dry yeast.

The best results for all the studied parameters as plant height, stem diameter, leaf area, number of branches per plant, fresh and dry weight of leaves and shoots and N, P and K% were obtained from the treatment of 1/2 NPK + compost grown in clay or sandy clay soil. On the other hand, the significant highest chlorophyll a was obtained from plants grown in clay or sand+clay (1:1) soils and fertilized by 1/2 NPK+ active dry yeast in the first season and in the second one from plants grown in clay soil and received full dose of NPK, while the highest significant value of chlorophyll (b) was obtained from plants grown in clay soil and fertilized by 1/2 NPK+ compost in both seasons, but the highest significant total carbohydrates content was resulted from plants grown in sand+ clay (1:1) soil and received 1/2 NPK + compost in the first season and those grown in clay soil and received NPK full dose in the second one. However, the best results for root fresh and dry weights were obtained from the treatment of NPK full dose grown in clay or sandy clay soil.

Key words: *Cestrum aurantiacum, soil type, fertilization.*

INTRODUCTION

Shrubs are considered the middle level of gardening designs, as they are bigger than flowers and yet littler than trees. Therefore, they assist infinitely in allowing for a diversified and proportionate landscape theme. They may aid to cushion the lines of a home; they may work as an ornamental backdrop for flowers and can conceal things that do not wish to be viewed. In addition, they add character and shape to a yard, allowing trimming and cultivating them as wish. They also tend to be able to grow and reach maturity very rapidly, and last a long time. You can today find suitable shrubs that offer striking color, bloom in different seasons, conceal spots where grass just will not grow and achieve additional goals in a landscape design.

Orange cestrum, orange jasmine night blooming jasmine or yellow cestrum (*Cestrum aurantiacum*) is evergreen rambling or half climbing shrub (1–2.6 m height) with light green ovate leaves and belongs to Family *Solanaceae*. Flowers orange-yellow, tubular, in axillary and terminal clusters or bright orange-yellow 2.5cm flowers with relaxed lobes, have pleasant smell, and appear from January to April. It is used as a medicinal aromatic plant and in landscaping (Huxley, 1990).

Growing media are an integral part of most horticultural production systems. There is a wide range of media available, when selecting media, the grower needs to find the optimum balance between their requirements and those of plants to be grown. The intensive use of chemical fertilizers at extremely high doses for a long period decreased the potential activity of micro –flora and the stability of soil organic matter and caused environmental pollution problems (Pokorna, 1984). Therefore, using organic fertilizers and active dry yeast in cultivation is very important and they are feasible alternative for the prevention of either NH_4 or No_3 phytotoxicity with fertilizers containing urea or NH_4 and other expensive chemical fertilizers.

The present work aimed to investigate the effect of various combinations of fertilizer sources, i.e. chemical or organic fertilizers and dry yeast on the vegetative growth and chemical analysis of cestrum transplants grown in different soils (substrates) (clay, sand and their mixture 1:1 by volume), to find out the best fertilization treatment and most suitable soil for it.

MATERIALS AND METHODS

The present investigation was carried out during the two successive seasons of 2005/2006 and 2006/2007 to study the effect of some fertilization treatments on *Cestrum aurantiacum* transplants grown in pots filled with different soils at Floricultural Research Branch. Antoniados Garden, Alexandria, Hort. Ins., Ministry of Agriculture, Egypt.

Three types of soil were used in the experimental pots (sand, clay or sand clay 1:1 (v/v)). The chemical properties of the experimental soils were shown in Tables (A, B and C), according to Jackson (1962).

At October 1st 2005 and 2006 seasons, cuttings (20 cm length) of *Cestrum aurantiacum* were planted in black polyethylene bages of 15 cm diameter containing a mixture of clay and sand 1:1 (v/v) and

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arranged in a plastic house. Uniform plants of 30 cm height were transplanted on April 1st 2006 in pots of 25 cm diameter containing the used experimental soil. The used fertilizers were ammonium sulphate (20.5%N) at the rate of 30 g /plant (full dose) (Gabra, 2004) applied in five equal doses starting on May 15th with 30 days intervals, 24 g/plant (full dose) calcium super phosphate (15.5%P_2O_5) divided into two equal doses, the first one was applied with soil preparation and the other one was added after three month from planting and 12 g/plant potassium sulphate (48% K_2O) (full dose) divided into three equal doses added from May 15th with 30 days intervals. Organic fertilizer (poultry manure + animals and plants refuse compost from Inter. Egypt El Salam Co. for Organic Fertilizers Production) was added before planting during the soil preparing at the rate of 15 % of soil weight (Ugaja, 1996).

Table (A): Chemical properties of the experimental soils before plantation.

Sample No.	pH	E.C. dS/m	Cations (meq./ l)				Anions (meq./ l)			
			Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3^{--}	HCO_3^{-}	CL^{-}	SO_4^{--}
1- Sand	7.70	2.00	3.20	1.07	1.30	0.80	-	2.66	1.31	2.58
2- Clay	7.83	1.59	2.11	1.84	1.14	1.64	-	3.15	1.17	3.64

Table (B): Physical properties of the experimental soils samples before plantation.

Sample No.	Sand %	Silt %	Clay %	Texture
1- Sand	97.40	0.00	2.60	sandy
2- Clay	8.20	5.50	86.30	clay

Table (C): Macro-elements (NPK) in the experimental soils before plantation.

Sample No.	N "ppm"	P "ppm"	K "ppm"
1- Sand	2.75	0.16	58.00
2- Clay	38.25	22.19	273.00

Table (D): Compost analysis report:

Test	Result	Test	Result
Weight of full dried cubic meter kg/m^3	440	Total potassium %	1.23
Moisture percentage %	20	Calcium %	1.50
pH	6.74	Magnesium %	0.79
EC (dS/m)	4.6	Iron (ppm)	1021
Water Holding Capacity	250-300	Manganese (ppm)	111
Total N%	2-2.5	Cupper (ppm)	180
Organic matter %	70-75	Zinc (ppm)	28
Organic carbon %	33.26	Boron (ppm)	---
Ash %	25-30	Nematode	Non
Carbon: nitrogen ratio (C/N ratio)	16:1	Herbs seeds	Non
Total phosphorus %	1.47	parasites	Non

Active dry yeast 2 g/ l (Ahmed, *et al.*, 2001) was applied as a foliar spray three times starting 20 days after planting with 30 days intervals. All other agricultural practices (irrigation, weeding, etc.) were done whenever needed as performed by local growers. The fertilization treatments were conducted as follows:

1-Control (without fertilization)
2- A full dose of NPK
3- 1/2 dose NPK + active dry yeast
4- 1/2 dose NPK + compost
5-Compost + active dry yeast

The layout of the experiment was randomized complete blocks design (RCBD) in factorial experiment containing three replicates Snedecor and Cochran (1967). At the end of the experiments of each season (Nov.15th), the following data were recorded:

A. Vegetative characters

- Plant height (cm)
- Stem diameter (cm), 15cm above ground.
- Number of lateral branches/plant
- Leaf area/ plant (cm^2).
- Fresh and dry weights of aerial parts/ plant (g).
- Fresh and dry weights of roots/ plant (g).

B. Chemical characters

-Chlorophyll content a & b (mg/ g fresh weight) in fresh leaves were determined on 1st August, 2006 and 2007 according to Arnon (1949).

-Total carbohydrates percentage in leaves was determined according to Herbert *et al.* (1971) after the end of experiment on 15th Nov. 2006 and 2007.

-Leaf minerals contents as nitrogen and Phosphorus percentages were colourmetrically determined as described by Evenhuis and Deward (1980) and Murphy and Riely (1962) respectively. Potassium percentage was measured using flame photometer according to Jackson (1962) after the end of the experiment on 15th Nov. 2006 and 2007.

Means of the individual factor and their interaction were compared by Duncan's Multiple Rang Test according to Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

Effect of soil type, fertilization treatments and their interactions on the growth and chemical composition of *Cestrum aurantiacum*

A. Effect on growth characters

A.1. Plant height

Regarding the soil type, data in Table (1) showed that either clay soil or sandy clay (1:1) soil without significant difference between them caused a significant increase in plant height compared with the sandy soil in both seasons. In the first season, plant heights were 90.07, 89.13 and 74.47 cm for clay, sandy clay (1:1) and sandy soil respectively and in the second season in a descending order were 96.33, 96.20 and 80.93 cm for clay, sandy clay (1:1) and sandy soils respectively. For fertilization treatments, the treatment of ½ NPK + compost gave the tallest plants in both seasons (107.00 and 111.11cm) respectively. Either clay soil or sandy clay soil resulted in the tallest plants which may be due to the more organic matter and nutrient elements, as well as higher water holding capacity than sandy soil which was reflected on the uptake of nutrients and water by the roots, consequently were more active in a metabolic processes, i.e increased plant height in comparison with the other ones.

Plants grown in sand+clay (1:1) soil and1/2NPK+compost gave the tallest plants in the first season (116.00 cm), whereas in the second season they were resulted from plants grown in sand + clay and clay soils and received 1/2NPK+compost (115.67a and 117.67a cm) respectively. These results are in agreement with those of Katiyar *et al.* (1999) on rose and Hegazi (2004) on *Jasminum grandiflorum* and *Lawsonia inermis.*

A.2.Stem diameter

As for the effect of soil type on stem diameter, data in Table (1) pointed out that either clay or sandy clay soil caused a significant increase in stem diameter compared with the sandy soil without significant difference between them in the first season (1.21, 1.21 and 1.12cm) respectively. In the second season, sandy clay soil (1:1) gave the significantly highest results (1.31cm) compared with the others. The best fertilization treatment in both seasons was 1/2NPK+compost (1.39 and 1.44 cm) respectively.

Cestrum transplants planted in either clay or sand + clay soils and fertilized with 1/2NPK+compost gave the thickest stems in the first season whereas in the second one the thickest stems were obtained from the transplants planted in sand+clay (1:1) soil and fertilized with 1/2NPK+compost (1.44, 1.43 and 1.48cm) respectively. This result may be due to the increase in available amounts of N, P and K as well as the improvement in the soil physical and chemical properties from adding the compost because it contains nutrient elements, some amino acids, sugars, auxins and organic matter which accelerated the growth and played an important role in the metabolic processes producing more cells in the cambium zone. These results are in conformity with those of Rahman and Ishtiaq (1996) on *Jasminum sambac*, Burki *et al.* (1998) on *Cestrum nocturnum* and Attia (2000) on *Lawsonia inermis.*

Table (1): Effect of soil type, fertilization treatments and their interaction on plant height (cm) and stem diameter (cm) of *Cestrum aurantiacum* during 2005/2006 and 2006/2007 seasons.

Fertilization treatments	Soil type							
	Plant height (cm)				Stem diameter (cm)			
	Sandy	Clay	Sand+clay (1:1)	Mean	Sandy	Clay	Sand+clay (1:1)	Mean
First season								
Control	52.67j	67.67h	56.97i	59.00E	0.71j	0.85i	0.90h	0.82E
NPK (full dose)	86.67fg	97.67c	92.67de	92.34B	1.36b	1.38b	1.37b	1.37B
1/2NPK+dry yeast	68.00h	90.00ef	95.00cd	84.33C	1.23d	1.19ef	1.17f	1.20C
1/2NPK+compost	95.00cd	110.00b	116.00a	107.00A	1.31c	1.44a	1.43a	1.39A
Compost+dry yeast	70.00h	85.00g	85.33g	80.00D	1.01g	1.21de	1.18f	1.13D
Mean	74.47B	90.7A	89.13A		1.12B	1.21A	1.21A	
Second season								
Control	40.33i	72.67g	60.67h	57.89E	0.75k	0.92j	0.98i	0.88D
NPK (full dose)	97.67d	108.33b	107.33bc	104.44B	1.34f	1.42bc	1.47a	1.41B
1/2NPK+dry yeast	90.33e	100.33d	104.67c	98.44C	1.40cde	1.39de	1.37ef	1.39B
1/2NPK+compost	100.00d	117.67a	115.67a	111.11A	1.41bcd	1.43b	1.48a	1.44A
Compost+dry yeast	76.33g	82.67f	92.67e	83.89D	0.97i	1.17h	1.25g	1.13C
Mean	80.93B	96.33A	96.20A		1.17C	1.27B	1.31A	

Means within a column having the same letters are not significantly different according to Duncan,s Multiple Range Test.

A.3. Leaf area

It is clear from the data in Table (2) that the largest leaf areas in the first season were noticed by the plants planted in clay soil and in the second one for those planted in sand + clay and clay soils without significancy between them. Referring to the fertilization treatments, the largest significant leaf areas were resulted from full dose of NPK, 1/2NPK+dry yeast and 1/2NPK+compost treatments in both seasons. For the interaction, the largest significant leaf areas were recorded by plants received full dose of NPK in the first season and by plants received1/2NPK+compost in the second one planted in clay soil. The least significant leaf area resulted from control plants in both seasons.

These results may be attributed to considerable available amounts of nutrient elements, especially N, P and K as well as more microbial activities in the root zone in either clay or sandy clay soils, which led to an increase in nutrients uptake by plants, an increase in photosynthesis and other biological processes, which reflected on the cell width, elongation and division consequently leaf area. These findings are in harmony with those of Awad *et al.* (1994) on poinsettia and Atta-Alla (1997) *on Dracaena marginata, Ficus benjamina, Schefflera arboricola* and *Syngonium podophyllum.* Likewise, Kandeel *et al.* (2008) *on* jasmine concluded that the best results for leaf area were resulted from full dose of NPK and ½ NPK + bio and organic fertilizers.

Table (2): Effect of soil type, fertilization treatments and their interaction on leaf area/ plant (cm^2) and number of shoots/ plant of *Cestrum aurantiacum* during 2005/2006 and 2006/2007 seasons.

Fertilization treatments	Soil type							
	Leaf area/ plant (cm^2)				Number of shoots/ plant			
	Sandy	Clay	Sand+clay (1:1)	Mean	Sandy	Clay	Sand+clay (1:1)	Mean
First season								
Control	545.60h	936.00fg	646.20gh	709.27C	3.00f	4.00ef	4.67e	3.89C
NPK (full dose)	2033.40e	3762.00a	2627.12cd	2807.51A	4.67e	7.67ab	6.00cd	6.11B
1/2NPK+dry yeast	2066.60e	3333.43b	2333.40de	2577.81A	5.00de	7.67ab	6.00cd	6.22B
1/2NPK+compost	2100.00e	3340.57b	2338.40de	2592.99A	6.33c	8.33a	8.33a	7.66A
Compost+dry yeast	1052.00f	2923.98c	2046.60e	2007.53B	4.00ef	6.67bc	6.00cd	5.56B
Mean	1559.52C	2859.20A	1998.34B		4.60B	6.87A	6.20A	
Second season								
Control	922.79h	1117.91gh	1289.30g	1110.00C	4.33g	4.67fg	4.33g	4.44D
NPK (full dose)	2348.60e	2710.93bcd	2914.44bc	2657.99A	6.00cde	6.33cd	6.67c	6.33B
1/2NPK+dry yeast	2470.93de	2610.47cde	2704.88bcd	2595.43A	5.33ef	6.67c	8.67b	6.89B
1/2NPK+compost	2509.53de	3243.49a	3039.07ab	2930.70A	6.00cde	9.67a	10.00a	8.56A
Compost+dry yeast	1362.33g	1830.93f	2467.67de	1886.98B	4.33g	5.67de	6.00cde	5.33C
Mean	1922.84B	2302.74A	2483.07A		5.20C	6.60B	7.13A	

Means within a column having the same letters are not significantly different according to Duncan,s Multiple Range Test.

A.4. Number of shoots

Data of the effect of soil type, fertilization treatments and their interactions on number of shoots/ plant are shown in Table (2). It is clear that, both clay and sand +clay (1:1) soils gave the greatest number of shoots /plant in the first season without significant difference between them (6.87 and 6.20/ plant) respectively. In addition, 1/2NPK+compost fertilization treatment gave the best results in the same season too (7.66/ plant). In the second season sand +clay (1:1) soil and 1/2NPK+compost fertilization treatment gave the best results (7.13 and 8.56/ plant) respectively. As for the interaction the combination between the two used factors showed that the plants grown in clay soil or sand +clay (1:1) soil and received 1/2NPK+compost fertilization treatment gave the significant greater shoots number per plant in both seasons (8.33 and 8.33/ plant) in the first season and 9.67 and 10.00/ plant in the second season respectively. On the other hand, the control plants grown in sandy soil in both seasons or sandy+ clay soil in the second one resulted in the least shoots number of 3.00, 4.33 and 4.33/ plant consecutively.

These results might be due to the positive effect of N, P and K from NPK fertilizer or compost as well as organic matter, amino acids, sugars, organic acids and auxins from compost on shoot number and

might be related to the improvement of physical and chemical conditions of the soil, providing energy for microorganisms activity and increased availability and uptake of nutrients, which was positively reflected on the shoot number. In addition to that sandy clay soil resulted in plants with more shoots than the other one, which may be due to better rhizosphere conditions for the roots in this soil which improved the uptake of water and nutrients. These results are in harmony with those of El-Mahrouk (2000) on *Swietenia mahogoni*, Auda *et al.* (2004) and Gabra (2004) on *Bougainvillea glabra.*

A.5. Leaves fresh and dry weights

Data in Table (3) showed that sandy clay (1:1) soil caused a significant increase in leaves fresh weight than others in both seasons as gave 100.07 and 106.77g/ plant respectively. Transplants fertilized with full dose of NPK or 1/2NPK+compost gave the significantly heaviest leaves fresh weight without significant differences in the first season as gave 111.28 and 113.42g/ plant respectively while in the second one were those treated with1/2NPK+compost as gave 126.02g/ plant. For the interaction, transplants grown in sand+ clay soil and received NPK full dose in the first season and those grown in clay soil and fertilized with 1/2NPK+compost in the second one gave the highest significant values of 131.67 and 139.47g/ plant respectively. As for leaves dry weight, data show that shrubs planted in clay or sand +clay (1:1) soils gave the best results without significancy in the first season as gave 13.31 and 14.21g/ plant respectively. Likewise, those fertilized with full dose of NPK, 1/2NPK+dry yeast or 1/2NPK+compost gave the heaviest dry leaves in the first season as gave 15.97, 14.34 and 15.56g/ plant respectively but, in the second one were those planted in sand +clay (1:1) soil or those fertilized with 1/2NPK+compost as recorded 15.87 and 16.59g/ plant respectively.

Referring to the interaction, transplants grown in sand +clay soil and fertilized with NPK full dose and those grown in clay soil and fertilized with 1/2NPK+compost resulted in the significantly highest leaves dry weight. But in the second season that result recorded for plants grown in sand +clay soil and fertilized with either NPK full dose or 1/2NPK+compost.This result might be attributed to that adding NPK, compost and yeast to the used soils improved the physical and chemical properties of them that led to better photosynthesis and biosynthesis processes, consequently increased fresh and dry matter accumulation. Similarly, were the results of Rahman and Ishtiaq (1996) on *Jasminum sambac*, Ghausur *et al.* (1997) on *Nerium oleander* and Burki *et al.* (1998) on *Cestrum nocturnum.*

Table (3): Effect of soil type, fertilization treatments and their interaction on leaves fresh and dry weights /plant (g) of *Cestrum aurantiacum* during 2005/2006 and 2006/2007 seasons.

Fertilization treatments	Soil type							
	Leaves fresh weight/ plant (g)				Leaves dry weight/ plant (g)			
	Sandy	Clay	Sand+clay (1:1)	Mean	Sandy	Clay	Sand+clay (1:1)	Mean
First season								
Control	27.45g	33.65f	32.76f	31.29D	4.33f	5.34f	5.20f	4.96C
NPK (full dose)	101.67c	100.50c	131.67a	111.28A	11.59e	15.63bc	20.70a	15.97A
1/2NPK+dry yeast	103.33c	100.40c	116.67b	106.80B	11.78e	15.56bc	15.68b	14.34A
1/2NPK+compost	105.00c	118.33b	116.92b	113.42A	11.97de	19.00a	15.71b	15.56A
Compost+dry yeast	52.60e	70.91d	102.33c	75.28C	6.00f	11.03e	13.75cd	10.26B
Mean	78.01C	84.76B	100.07A		9.13B	13.31A	14.21A	
Second season								
Control	39.68k	48.07j	55.44i	47.73D	6.23j	7.55ij	8.70hi	7.49D
NPK (full dose)	100.99g	116.57d	125.32c	114.29B	11.82fg	14.92d	18.51ab	15.08B
1/2NPK+dry yeast	106.25f	112.25de	116.31d	111.60B	12.43f	14.37de	17.18bc	14.66C
1/2NPK+compost	107.91ef	139.47a	130.68b	126.02A	12.63ef	17.85ab	19.30a	16.59A
Compost+dry yeast	58.58i	78.93h	106.11f	81.21C	6.85ij	10.08gh	15.67cd	10.87C
Mean	82.68C	99.06B	106.77A		9.99C	12.95B	15.87A	

Means within a column having the same letters are not significantly different according to Duncan,s Multiple Range Test.

A.6. Shoots fresh and dry weights

In respect to the effect of soil type and fertilization treatments data in Table (4) cleared that sand+clay (1:1) soil and 1/2NPK+compost fertilization treatments gave both the heaviest fresh weight of shoots in the two seasons. The best results for shoots dry weight resulted from transplants planted in sand +clay (1:1) soil and that fertilized with 1/2NPK+compost in the first season and those

fertilized with full dose of NPK, 1/2NPK+dry yeast or 1/2NPK+compost without significant differences among them in the second one. Also, data showed that the combination between both sand +clay (1:1) and 1/2NPK+dry yeast or 1/2NPK+compost for shoots fresh weight or with 1/2NPK+compost for dry weight in the first season gave the highest values. While in the second one, transplants treated with the combination between sand +clay (1:1) soil and 1/2NPK+compost gave the heaviest shoots fresh and dry weights.

Table (4): Effect of soil type, fertilization treatments and their interaction on shoots fresh and dry weights/ plant (g) of *Cestrum aurantiacum* during 2005/2006 and 2006/2007 seasons.

Fertilization treatments	Soil type							
	Shoots fresh weight/ plant (g)				Shoots dry weight/ plant (g)			
	Sandy	Clay	Sand+clay (1:1)	Mean	Sandy	Clay	Sand+clay (1:1)	Mean
First season								
Control	42.37g	54.58fg	51.59fg	49.51D	16.95i	21.83h	20.64h	19.81C
NPK (full dose)	109.44e	144.44bc	155.00ab	136.29BC	39.15g	51.67de	55.44bc	48.75B
1/2NPK+dry yeast	132.78	133.33cd	161.11a	142.41B	47.50f	44.75f	54.07cd	48.77B
1/2NPK+compost	142.22bcd	148.33abc	166.22a	152.26A	50.87e	57.70b	64.44a	57.67A
Compost+dry yeast	125.41de	133.23cd	131.84cd	130.16C	44.86f	51.83de	51.11de	49.27B
Mean	110.44C	122.78B	133.15A		39.86C	45.55B	49.14A	
Second season								
Control	45.99j	56.83i	55.61i	52.81E	18.55g	22.92f	22.43f	21.30C
NPK (full dose)	132.81efg	140.47d	146.65c	139.98C	47.49d	50.36cd	58.66b	52.17A
1/2NPK+dry yeast	137.20de	133.33efg	160.92b	143.82B	47.69d	51.84c	60.01b	53.18A
1/2NPK+compost	130.52g	159.91b	169.56a	153.33A	49.28cd	57.38b	63.23a	56.63A
Compost+dry yeast	118.64h	132.21fg	135.43ef	128.76D	43.61e	47.44d	50.50cd	47.18B
Mean	113.03C	124.55B	133.63A		41.33B	45.99B	50.97A	

Means within a column having the same letters are not significantly different according to Duncan,s Multiple Range Test.

This result may be attributed to that, the plants grown in clay and sand clay soils, which received NPK full dose and ½ NPK combined with either compost or dry yeast produced the heaviest shoot dry weights values which may be due to the increase in shoot fresh weights as well as more dry matter accumulation as a result from using these treatments, which had beneficial effects on the plant growth. These results are in harmony with those of Fazli and Ishtiaq (1996) on *Bougainvillea spectabilis* cv. White, Ughaja (1996) on *Ricinus communis*, Ali (1998) on *Lawsonia inermis*, and Hegazi (1999) on *Jasminum grandiflorum*.

Table (5): Effect of soil type, fertilization treatments and their interaction on roots fresh and dry weights/ plant (g) of *Cestrum aurantiacum* during 2005/2006 and 2006/2007 seasons.

Fertilization treatments	Soil type							
	Roots fresh weight/ plant (g)				Roots dry weight/ plant (g)			
	Sandy	Clay	Sand+clay (1:1)	Mean	Sandy	Clay	Sand+clay (1:1)	Mean
First season								
Control	25.04k	40.15j	40.01j	35.07E	6.42h	10.29g	10.25i	8.99D
NPK (full dose)	109.72f	187.46a	165.56b	154.25A	25.59d	40.70a	42.14a	36.14A
1/2NPK+dry yeast	80.37g	117.78e	132.65d	110.27C	18.74e	29.10c	31.11c	26.32B
1/2NPK+compost	133.76d	157.10c	159.00c	149.95B	31.19c	36.96b	37.29b	35.15A
Compost+dry yeast	63.11i	73.49h	81.42g	72.67D	14.72f	18.16e	18.47e	17.11C
Mean	82.40B	115.20A	115.73A		19.33B	27.04A	27.85A	
Second season								
Control	36.42l	48.79j	43.48k	42.90E	9.11i	12.20h	10.87hi	10.72E
NPK (full dose)	141.36d	173.24b	214.95a	176.52A	35.34c	43.31b	53.74a	44.13A
1/2NPK+dry yeast	91.20h	127.78g	132.18f	117.05C	22.80f	31.95e	33.05de	29.26C
1/2NPK+compost	136.70e	172.40b	166.10c	158.40B	34.18cd	42.10b	41.53b	39.27B
Compost+dry yeast	46.29jk	71.23i	87.62h	68.38D	11.75h	17.81g	21.91f	17.15D
Mean	90.39C	118.69B	128.87A		22.64C	29.47B	32.22A	

Means within a column having the same letters are not significantly different according to Duncan,s Multiple Range Test.

A.7. Roots fresh and dry weights

It is quite evident from the obtained results in Table (5) that clay and sand +clay (1:1) soils or NPK full dose treatment gave the highest values for roots fresh weight in the first season whereas in the second one, sand +clay (1:1) soil and NPK full dose fertilization treatments gave the best results. The combination between clay soil and NPK full dose in the first season or between sand +clay (1:1) soil and NPK full dose treatments gave the best results in the second one.

As for roots, dry weight data took the same trend of roots fresh weight for the effect of both soil type or their interaction with fertilization treatments in addition to 1/2NPK+compost treatment in the first season, which gave a higher, values too. Applying NPK, compost and dry yeast to clay soil may accelerate the enzymatic activities, hence enhancing biosynthesis processes in the plant, that lead to improve in growth parameters. Similar results were obtained by El-Tarawy *et al.* (1991) on *Acalypha macrophylla*, Burki *et al.* (1998) on *Cestrum nocturnum* and Auda *et al.* (2004) and Gabra (2004) on *Bougainvillea glabra.*

B. Effect on chemical composition

B.1.Chlorophyll a & b contents

It is appeared from data presented in Table (6) that both chlorophyll a & b contents in the leaves of *Cestrum aurantiacum* were the highest without significancy when clay and sand +clay (1:1) soils were used in the first season, whereas in the second one were the clay soil for chlorophyll a and both clay and sand +clay (1:1) soils without significant differences between them for chlorophyll a & b contents respectively. The treatment of 1/2NPK+dry yeast was the best for both chlorophyll a & b contents in the first season whereas in the second one were the treatments of full dose of NPK and 1/2NPK+dry yeast without significancy for chlorophyll a and 1/2NPK+dry yeast and 1/2NPK+compost without significancy for chlorophyll b.

Table (6): Effect of soil type, fertilization treatments and their interaction on chlorophyll a & b contents (mg/ g fresh weight) in the leaves of *Cestrum aurantiacum* during 2005/2006 and 2006/2007 seasons.

Fertilization treatments	Soil type							
	Chlorophyll a (mg/ g fresh weight)				Chlorophyll b (mg/ g fresh weight)			
	Sandy	Clay	Sand+clay (1:1)	Mean	Sandy	Clay	Sand+clay (1:1)	Mean
First season								
Control	1.70j	2.00hi	1.99i	1.90E	0.59d	0.69d	0.64e	0.64C
NPK (full dose)	2.10g	2.19ef	2.30bc	2.20C	0.61f	0.70d	0.73c	0.68C
1/2NPK+dry yeast	2.23d	2.44a	2.46a	2.38A	0.77b	0.78ab	0.78ab	0.78A
1/2NPK+compost	2.17f	2.33b	2.29c	2.26B	0.73c	0.80a	0.70d	0.74B
Compost+dry yeast	2.03h	2.21de	2.18ef	2.14D	0.66e	0.70d	0.74c	0.70C
Mean	2.05B	2.23A	2.24A		0.67B	0.73A	0.72A	
Second season								
Control	1.77j	1.90li	1.92i	1.86D	0.50i	0.58h	0.52i	0.53D
NPK (full dose)	2.13g	2.50a	2.36c	2.33A	0.59h	0.72def	0.68g	0.66C
1/2NPK+dry yeast	2.10g	2.44b	2.45b	2.33A	0.73de	0.78b	0.78b	0.76A
1/2NPK+compost	2.19f	2.35c	2.28d	2.27B	0.74cd	0.81a	0.70efg	0.75A
Compost+dry yeast	2.05h	2.17f	2.23e	2.15C	0.67g	0.69fg	0.76bc	0.70B
Mean	2.05C	2.27A	2.25B		0.64B	0.71A	0.69A	

Means within a column having the same letters are not significantly different according to Duncan,s Multiple Range Test.

As for interaction, data showed that the combination between 1/2NPK+dry yeast and clay soil or sand +clay (1:1) soil for chlorophyll a in the first season; NPK full dose and clay soil for chlorophyll a in the second season; 1/2NPK+dry yeast and both clay or sand +clay (1:1) soils, and 1/2NPK+compost and clay soil for chlorophyll b in the first season and 1/2NPK+compost and clay soil for chlorophyll b in the second season respectively gave the best results. These results may be due to the improvement role of N, P and K as well as macro elements, organic acid, amino acids, sugars, auxins and vitamins from applying compost and dry yeast in accelerating the pigments content (Wange, 1996 and Erhart and Hartl, 2006). Similar findings were obtained by Koriesh *et al.* (1990) on rose cv. *Baccara* transplants, El-Fadaly (1994) on *Jasminum sambac* and Attia (2000) on *Lawsonia inermis.*

B.2.Total carbohydrate content

Data presented in Table (7) clearly indicated that in the first season cestrum shrubs planted in sand +clay (1:1) soil; those fertilized with 1/2NPK+compost as gave the best values. For interaction between sand +clay (1:1) soil and 1/2NPK+compost gave the highest total carbohydrates

contents (mg/ g dry weight). While in the second one transplants planted in clay or sand +clay (1:1) soil without significant differences between them and those fertilized with NPK full dose or the interaction between clay soil and NPK full dose gave the best results. This results may be referred to the action of NPK full dose or 1/2NPK + compost in improving clay and sandy clay soils physical and chemical properties, that accelerated the photosynthesis and biosynthesis processes in plants, hence increase metabolic processes as carbohydrates accumulation. These findings are supported by finding of El-Fadaly (1994) on *Jasminum sambac*, and El-Sallami and Mahros (1997) on *Thuja orientalis*.

B.3. Nitrogen percentage

Data in table (7) showed that sand +clay (1:1) soil in the first season and both clay and sand +clay (1:1) soils without significant differences between them in the second season gave the highest N percentage. Likewise, 1/2NPK+compost fertilization treatments gave the highest N percentage in both seasons. Also, the interaction between sand +clay (1:1) soil and 1/2NPK+compost in the first season and between sand +clay (1:1) soil and both NPK full dose and 1/2NPK+compost in the second one gave the best results.

These results are in harmony with those of Koriesh *et al.* (1990) and Abbass (2003) on *Rosa* spp and Gabra (2004) on *Bougainvillea glabra*.

Table (7): Effect of soil type, fertilization treatments and their interaction on total carbohydrates (mg/ g dry weight) and nitrogen percentage in the leaves of *Cestrum aurantiacum* during 2005/2006 and 2006/2007 seasons.

Fertilization treatments	Soil type							
	Total carbohydrates (mg/ g dry weight)				N%			
	Sandy	Clay	Sand+clay (1:1)	Mean	Sandy	Clay	Sand+clay (1:1)	Mean
First season								
Control	21.50i	24.31g	23.04h	22.95E	1.57l	2.31k	2.50j	2.13E
NPK (full dose)	30.62d	33.01c	30.12d	31.25C	2.76h	3.00d	3.15b	2.97B
1/2NPK+dry yeast	32.30c	33.26c	32.82c	32.79B	2.66i	3.00d	3.00d	2.89C
1/2NPK+compost	33.44c	36.33b	44.03a	37.93A	2.83f	3.03c	3.18a	3.01A
Compost+dry yeast	26.23f	27.18ef	27.74e	27.05D	2.67l	2.91e	2.80g	2.79D
Mean	28.82C	30.82B	31.55A		2.50C	2.85B	2.93A	
Second season								
Control	20.09K	22.73j	22.99j	21.94D	1.74j	2.30h	2.23i	2.09D
NPK (full dose)	29.45f	39.27a	38.41b	35.71A	2.51g	2.98c	3.11a	2.87B
1/2NPK+dry yeast	26.65h	33.26d	32.72d	30.88B	2.59f	3.00c	2.99c	2.86B
1/2NPK+compost	24.18i	36.74c	33.57d	31.50B	2.85d	3.07b	3.10a	3.01A
Compost+dry yeast	27.77g	31.50e	30.86e	30.04C	2.58f	2.83d	2.74e	2.72C
Mean	25.63B	32.70A	31.71A		2.45B	2.84A	2.83A	

Means within a column having the same letters are not significantly different according to Duncan,s Multiple Range Test.

B.4. Phosphorus percentage

Referring to the effect of both soil type, fertilization treatments and their interactions data in Table (8) showed that, cestrum transplants treated with clay and sand +clay (1:1) soils without significant differences and NPK full dose and 1/2NPK+compost without significant differences or the interaction between NPK full dose and clay soil or between 1/2NPK+compost and both clay and sand +clay (1:1) soils gave the highest phosphorous percentage in the first season. In the second season were the corresponding treatments beside compost + dry yeast and the interaction between sand +clay (1:1) soil and both NPK full dose and Compost + dry yeast fertilization treatments. These results are in conformity with those of Hassan *et al.* (1994) on *Cupressus sempervirens*, El-Mahrouk (2000) on *Swietenia mahogoni* and Kandeel *at al.* (2008) on jasmine.

Table (8): Effect of soil type, fertilization treatments and their interaction on P and K percentages in the leaves of *Cestrum aurantiacum* during 2005/2006 and 2006/2007 seasons.

Fertilization treatments	Soil type							
	P%				K%			
	Sandy	Clay	Sand+clay (1:1)	Mean	Sandy	Clay	Sand+clay (1:1)	Mean
First season								
Control	0.12i	0.19h	0.21gh	0.17D	1.15j	1.63i	1.82h	1.53C
NPK (full dose)	0.22fg	0.27ab	0.26bc	0.25A	2.27cd	2.30c	2.44a	2.34A
1/2NPK+dry yeast	0.19h	0.22fg	0.22fg	0.21C	2.10e	2.00f	2.37b	2.16B
1/2NPK+compost	0.23ef	0.28a	0.27ab	0.26A	2.25d	2.38b	2.36b	2.33A
Compost +dry yeast	0.20h	0.24de	0.25cd	0.23B	1.96g	2.12e	2.35b	2.14B
Mean	0.19B	0.24A	0.24A		1.95C	2.09B	2.27A	
Second season								
Control	0.14g	0.18ef	0.17f	0.16C	1.13l	1.77k	2.03h	1.64D
NPK (full dose)	0.19def	0.25a	0.24ab	0.23A	2.30e	2.34e	2.52a	2.39A
1/2NPK+dry yeast	0.17f	0.19def	0.21cd	0.19B	2.10g	1.97i	2.46b	2.18C
1/2NPK+compost	0.20cde	0.26a	0.26a	0.24A	2.23f	2.40cd	2.38d	2.34B
Compost +dry yeast	0.18ef	0.22bc	0.25a	0.22A	1.93j	2.13g	2.43bc	2.16C
Mean	0.18B	0.22A	0.23A		1.93C	2.12B	2.36A	

Means within a column having the same letters are not significantly different according to Duncan,s Multiple Range Test.

B.5. Potassium percentage

Data in Table (8) revealed that the superiority of sand +clay (1:1) soil in both season; NPK full dose and 1/2NPK+compost fertilization treatments without significant differences in the first season; NPK full dose fertilization treatment in the second season and the interaction between sand +clay (1:1) soil and NPK full dose fertilization treatment in both season than all other treatments in both seasons. These results for N, P and K percentages may be referred to the increase in N, P and K amount in the root zone from applying NPK full dose or ½ NPK + compost to either clay or sandy clay soils, which had better effects on the physical and chemical soil properties, hence increased N, P and K uptake. Similarly, were the findings of of Hassan *et al.* (1994) on *Cupressus sempervirens*, and Younis *et al.* (2004) and Kandeel *at al.* (2008) on *Jasminum grandiflorum*.

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