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EFFECT OF MINERAL FERTILIZERS ON THE GROWTH AND FLOWERING OF *Fuchsia hybrida*

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ABSTRACT

The main objective of this research was to study the effect of three mineral fertilizers of different ratios and levels of NPK (+ Mg) on the vegetative growth and flowering of a local cultivar of *Fuchsia hybrida*. Also, to study the effect of these fertilizers on the mineral contents in the leaves of Fuchsia plants.

Three mineral fertilizers (19: 19: 19: 02), (19: 06: 20: 04) and (13: 40:13: 0) N, P, K and Mg were used at six levels 4, 6, 8, 10, 12 and 24 gram/plant/season. A control treatment (0 gram/plant/season) was used. The amount of fertilizer was divided into four equal doses and added to the plant at weekly intervals as a side dressing before irrigation.

The highest increase in plants height was obtained by adding 8 g/plant and 10 g/plant from the 19:19:19:02 fertilizer in both seasons. The fourth level (10 g/plant) of 19: 19: 19:02 fertilizer increased the shoot and the leaves fresh and dry weights in both seasons. The highest increase in the number of flowers per plant was obtained by adding 12 g/plant from the 19:06:20:04 fertilizer in both seasons.

There were significant increases in the nitrogen content in the leaves of Fuchsia plants over the control by using the different fertilizers. However, the fourth level (10 g/plant) of the 19:06:20:04 fertilizer gave the highest increase in both seasons. The highest increase in the phosphorus content was obtained by adding 24 g/plant from the 19:19:19:02 fertilizer. The fourth level (10 g/plant) from the 19:06:20:04 fertilizer gave the maximum increase in the potassium content in both seasons. Generally, the fifth level (12 g/plant) of the 19:19:19:02 fertilizer gave the maximum uptake of N, P and K compared with the other levels and fertilizers in both seasons.

INTRODUCTION

Fuchsia (*Fuchsia hybrida Voss)* plants belong to the family *Onagraceae*. About 1000 species are known, most of them are from Mexico, South of Chile, but there are a few in the West Indies, Tahiti and New Zealand. A wide range of growth form is found, from small perennials to the tree-size. Most species are shrubs, some evergreen, others deciduous. Fuchsia flowers can be distinguished by colors. The four sepals flares back are usually red, white or pink. The skirt like corolla beneath the sepals is made up of petals that may range from regal purples and magnificent reds to subtle lavender, mauve, rose or salmon. Most blossoms are pendulous, with pistil and stamens hanging down.

Fuchsia flower may be single, having only four petals, semi-double, with five to seven petals, or double, with many layers of petals.

Most Fuchsia hybrids flourish in climates where summer temperatures are cool and air is moist with strong indirect light.

Fuchsias are heavy feeders before they bloom. A fertilizer high in nitrogen, potassium and phosphorus must be added before planting. An application once a month full strength or once every two weeks at half-strength is recommended (Beckett, 1985).

The aim of this work was to study the effect of different ratios and levels of three mineral fertilizers (19: 19: 19: 02), (19: 06: 20: 04) and (13: 40:13: 0) N, P, K and Mg respectively, on the vegetative growth and flowering of *Fuchsia hybrida* under the prevailing conditions in Alexandria.

MATERIALS AND METHODS

The present work was carried out in two successive seasons 1991/1992 and 1992/1993 in the Experimental Station, Department of Floriculture, Ornamental Horticulture, and Garden Design, Faculty of Agriculture, Alexandria University, Alexandria, Egypt.

The plant used in this study was a "local cultivar" of *Fuchsia hybrida.* The cuttings were taken yearly (on September 8 th 1991 in the first season and on September 11 th 1992 in the second one) from the mother plants with a length of 10cm. These cuttings were planted in seed pans using 50 cuttings per pan. The cuttings were watered thoroughly after planting and placed in a partial shade place. After two months (on November 8 th 1991 and on November 12 th 1992 in the first and second seasons, respectively) when the roots were well formed, single rooted cuttings were transplanted in 10cm pots containing loamy soil (pH 7.5, contained 0.272% nitrogen, 0.002% phosphorus and 0.381% potassium). Six months later, the plants were transplanted to the 30cm pots containing the same medium used before. The plants were irrigated twice-a day during summer months, and at two days intervals during autumn to keep the soil moist. After four weeks from the last transplanting the inorganic fertilizer treatments were started.

Three inorganic fertilizers were used in this study. These fertilizers were (19: 19: 19: 2), (19: 6: 20: 4) and (13: 40: 13: 0) N: P_2O_5: K_2O: MgO. Six levels from each fertilizer i.e. 4.0, 6.0, 8.0, 10.0, 12.0 and 24.0g/ plant/season beside a control treatment (zero g/plant/season) were used. The amount of each fertilizer was divided into four equal doses and they were added to the plants as side dressing before irrigation (Joiner and Poole, 1967 and Johnson, 1976). Each quantity was added at weekly intervals (Joiner and Poole, 1967 Boodley *et al.,* 1968). This is necessary because the frequent watering in the summer leaches some of the elements from the soil and it must be replenished regularly .The final application of the fertilizer was done two to three weeks before the terminal buds reached the showing color stage (Lunt and kofranek, 1958 and Hiroyasu *et al*., 1971).

Growth measurements:

Plant height (cm): Every plant was measured from the surface of the soil to the top of the highest point of the plant at the end of the experiment and the average was calculated and recorded.

Leaves fresh weight (g): All leaves of each plant in the replicate were taken at the end of the experiment to determine the fresh weight, and then the averages were calculated and recorded.
Shoots fresh weight (g): All the shoots of each plant (without leaves) of each treatment in each replicate were taken at the end of the experiment to determine their fresh weight, and then the averages were calculated.
Leaves dry weight (g): At the end of the experiment, leaves of each plant were dried in an oven at 75°C for 72 hours to a constant weight. The averages were calculated.
Shoots dry weight (g): The dry weight of the shoot of every plant in every replicate was done at the end of the experiment by drying them in an oven at 75°C for 72 hours to a constant weight, then the averages were calculated and recorded.
Flower number per plant: All flowers of each plant were counted. The flowers count started from October 9 th 1992 to December 23 rd 1992 and from October 11 th 1993 to December 25 th1993 for the first and second seasons, respectively. The averages were recorded.
Chemical analysis of the leaves:
Nitrogen (N) content in leaves: Total nitrogen was determined by micro-Kieldahl method reported by Page *et al.* (1982).
Phosphorus (P) content in leaves: Samples from the leaves were dried and the ash was used for analysis. Phosphorus (P) was determined colorimeterically by using Vanada molybdate method. (Chapman and Pratt 1961).
Potassium (K) content in leaves: Potassium was determined colorrimetically using Vanadate molybdate yellow method at 470 nm wave length, (Chapman and Pratt 1961).
Nitrogen (N) uptake: The plant uptake of nitrogen is calculated according to the mathematical formula:
mg N /plant =(mg N /g plant tissue) X weight of plant (g).
Phosphorus (P) uptake: The uptake of phosphorus can resulted depending on the formula:
mg P /plant =(mg P /g plant tissue) X weight of plant (g).
Potassium (K) uptake: The uptake of K is calculated according to the formula:
mg K /plant =(mg K /g plant tissue) X weight of plant (g).

The experimental lay-out was designed to provide randomized complete blocks design with three replicates (Snedecor and Cochran, 1974). Every replicate contained 19 treatments and three plants were used for each treatment/ replicate (one plant per pot), in both seasons.

RESULTS AND DISCUSSION

Plant height: Data presented in Table (1) show that using the fertilizer (19:19:19:02) at 8 g/plant or 10 g/plant gave significant increases in the plant height of Fuchsia in the two seasons compared with the control treatment. These results were probably due to the high ratio of phosphorus in the

fertilizer. Phosphorus is an essential element for root formation and a source of energy, thus the plant height could be increased

Similar trend of results was reported by Khargakharate and Nirwal (1991) on sunflower, Avtar *et al*., (1993) on *Anethum graveolens L.* and El-Nakhlawy (1993) on sunflower**.**

Table 1: Mean values of plant height (cm), leaves fresh weight (g) and shoots fresh weight (g) of a local cultivar of *Fuchsia hybrida* as affected by the different fertilizers (ratios and levels) in the two seasons of 1991/1992 and 1992/1993.

Treatments		Plant height (cm)		Leaves fresh weight (g)		Shoots fresh weight (g)	
Fertilizer Ratios N: P: K: Mg	Levels (g)	First season	Second season	First season	Second season	First season	Second season
19:19:19:02	4.0	48.11	51.10	170.92	166.61	94.10	86.65
	6.0	50.99	52.13	111.65	122.65	67.06	62.78
	8.0	56.44	52.60	157.18	154.72	76.57	81.58
	10.0	55.05	63.41	176.44	179.02	102.20	93.57
	12.0	50.78	50.51	165.08	157.35	96.35	91.10
	24.0	45.11	51.90	133.64	144.37	99.96	89.74
Average		51.08	53.61	152.48	154.12	89.37	84.24
19:06:20:04	4.0	55.22	62.38	112.16	123.17	74.71	81.16
	6.0	51.11	53.51	104.17	114.09	62.87	66.50
	8.0	54.88	52.11	129.37	132.09	88.98	85.08
	10.0	46.33	51.43	109.25	111.14	76.52	76.58
	12.0	50.78	58.70	137.22	136.85	94.17	93.44
	24.0	45.99	51.80	138.58	140.10	67.29	63.47
Average		50.72	53.51	121.79	126.24	77.42	77.71
13:40:13:0	4.0	55.44	60.31	110.57	115.54	79.29	81.12
	6.0	48.66	58.15	107.79	120.51	61.23	72.06
	8.0	45.55	51.48	103.90	118.91	58.63	57.60
	10.0	49.88	48.08	113.68	117.07	68.13	74.54
	12.0	54.44	61.05	144.40	139.19	56.99	63.93
	24.0	50.11	53.75	102.58	113.04	62.55	59.57
Average		50.68	55.47	113.82	120.71	64.47	68.14
Control	0	40.75	46.02	95.54	96.75	54.71	52.79
LSD at $_{0.05}$		10.621	8.588	32.51	27.697	12.308	15.636

LSD at $_{0.05}$: Least significant difference test at 0.05 level of probability.

Leaves fresh weight: Data presented in Table (1) show that, using the first fertilizer (19:19:19:2) at 10g/plant gave the maximum increase in leaves fresh weight compared with the two other fertilizers. This result was probably due to that the first fertilizer had the suitable element's ratio for a good vegetative growth, consequently the leaves fresh weight of the Fuchsia would be increased.

Similar results were reported by Chase and Poole (1987) on *Syngoniym podophyllum*, Keever and Coob (1987) on *Euonymus japonicus*, Beech (1990) on lemongrass, Munsi (1990) on Japanese mint, EL Saeid *et. al.;*

(1996) on *Tagetes patula* plants and Van lersel *et. al.,* (1998) on Impatiens, Petunia, Salvia and Vinca.

However, increasing the fertilizer level over 10g/plant led to a reduction in the leaves fresh weight. These results were probably due to that using 10 g/plant from the first fertilizer was in adequate amount for Fuchsia plants to produce the maximum vegetative growth characteristics.

Similar trend of results was found by Lieres *et al.,* (1995) on *Salvia sclarea*.

Shoot fresh weight: Generally, the highest increase in shoot fresh weight was obtained by applying the fourth level (10 g/plant) of the fertilizer (19: 19: 19: 2) (Table 1). This result might be due to that this fertilizer had the suitable element's ratio for a good shoot fresh weight, consequently the shoot fresh weight of the Fuchsia would be increased.

Similar trend of results was found by El-Mahrouk *et al*. (1992) on *Helipterum roseum*, and *Delphinium ajacis L*.

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Leaves dry weight: Data of the two experimental seasons indicate that, the fertilizer (19: 19: 19: 2) was more effective in increasing the leaves dry weight than the two other fertilizers (Table 2). These results were probably related to that using this fertilizer at 10gm/plant supplied the Fuchsia plants with enough amount of N, P, K and Mg to allow the plants to grow well, consequently the dry weight of leaves would be increased.

Similar results were reported by Feigin *et al.* (1986) on greenhouse roses, El-Saeid *et al.* (1996) on *Tagetes patula*, Hosni and El-Shoura (1996) on carnations.

Shoot dry weight: The fertilizer (19: 19: 19: 2) was more effective in increasing the shoots dry weight than the two other fertilizers (Table 2). These results were probably due to that using this fertilizer at 10g/plant supplied the Fuchsia plants with enough amount of N, P, K and Mg to allow the plants to grow well, consequently the dry weight would be increased.

Similar results were reported by Bezzi (1987) on *Salvia officinalis*, Feigin *et al*. (1986) on greenhouse roses, El Saeid *et al.* (1996) on *Tagetes patula* plants and Van lersel *et al.* (1998) on *Impatiens, Petunia*, *Salvia* and *Vinca.*

Flower number per plant: Generally, the results of the two experimental seasons show that using any fertilizer at more than 10 g/plant gave significant increases in the number of flowers per plant compared with the control treatment (Table 2). This result was probably attributed to that using a suitable amount from any fertilizer could encourage flower formation, thus the flower number per plant could be increased.

Similar results were reported by Arora and Khanna (1986) on *Tagetes erecta*, Mukhopadhyay and Bankar (1986) on *Polianthus tuberosa*, Vass (1986) on Gerbera and Dufault *et al.* (1990) on Gerbera.

Furthermore, using 12gm/plant from the fertilizer (19: 6: 20: 4) gave the maximum flower number per plant, in the two seasons. This result could be

due to the presence of N, P and K at a proper ratio, which could encourage the vegetative growth; consequently the flower formation on Fuchsia plant would be increased.

Similar results were reported by Feigin *et al.* (1986) on greenhouse roses, Bhattacharjee (1988) on *Jasminum grandiflorum, Khargakharate and Nirwal (1991)on sunflower and Avtar* et al*. (1993) on* Anethum graveolens*.*

Table 2: Mean values of leaves dry weight (g), shoots dry weight (g) and number of flowers per plant of a local cultivar of *Fuchsia hybrida* as affected by the different fertilizers (ratios and levels) in the two seasons of 1991/1992 and 1992/1993.

Treatments		Leaves dry weight (g)		Shoots dry weight (g)		Number of flowers per plant	
Fertilizer Ratios N: P: K: Mg	Levels (g)	First season	Second season	First season	Second season	First season	Second season
19:19:19:02	4.0	21.48	20.00	17.74	16.32	133.33	142.00
	6.0	13.84	15.30	13.67	13.80	143.33	136.67
	8.0	19.52	19.93	14.61	14.33	189.33	181.33
	10.0	21.81	20.72	19.32	18.71	131.33	133.67
	12.0	21.28	21.57	18.23	19.94	202.00	202.00
	24.0	17.31	16.82	18.36	19.10	218.33	204.33
Average		19.21	19.06	16.99	17.03	169.61	166.67
19:06:20:04	4.0	14.46	15.06	15.71	17.65	133.67	139.00
	6.0	12.74	13.61	11.78	12.47	192.33	206.00
	8.0	16.27	17.90	18.48	18.09	185.67	196.33
	10.0	13.07	14.48	15.01	15.81	210.00	211.67
	12.0	16.88	18.21	17.16	20.04	250.00	250.67
	24.0	18.67	17.49	12.04	13.68	197.67	195.67
Average		15.35	16.13	15.03	16.29	194.89	199.89
13:40:13:0	4.0	13.54	19.67	15.76	14.70	180.00	178.67
	6.0	12.49	19.26	11.12	13.66	123.67	129.33
	8.0	12.39	17.65	12.17	14.74	152.33	151.67
	10.0	14.21	19.16	12.79	14.26	199.00	196.33
	12.0	14.74	20.31	10.40	12.92	171.00	199.33
	24.0	13.05	17.26	10.67	13.26	221.33	242.00
Average		13.40	18.88	12.15	13.92	174.56	182.89
Control	0	10.02	9.37	9.41	9.90	110.33	120.00
LSD at $_{0.05}$		4.278	3.850	3.851	3.861	44.346	41.213

LSD at $_{0.05}$: Least significant difference test at 0.05 level of probability.

Chemical analysis:

Nitrogen content and uptake: Generally, data of the two experimental seasons show that using any fertilizer, especially at suitable levels, led to a significant increase in the percentage of N in the leaves of Fuchsia plant and the amount of N- uptake compared with the control treatment (Table 3). These results was probably related to that the used medium had no enough amount of N, consequently any addition of N to the soil could be absorbed and translocated in the leaves.

Similar results were reported by Lang and Punnkuk (1998) on Guinea impatiens.

The fertilizer (19: 6: 20: 4) at 10 g/plant gave the maximum N content in Fuchsia leaves, compared with the control treatment in the two seasons. These results was probably attributed to that using 10gm/plant from this fertilizer led to increase the amount of N in the soil to the maximum value, consequently the Fuchsia plants could absorb high amount of N and store it in the leaves. Nitrogen is of extreme importance because it is a constituent of proteins and nucleic acids (Bidwell, 1974).

Similar trend of results was found by Vass and Hargital (1986) on Gerbera plants, and Yang *et al.* (1989) on Chrysanthemums.

Phosphorus content and uptake: Data presented in Table (3) indicate that using any level from any used fertilizer led to significant increase in the percentage of phosphorus in the leaves of Fuchsia plants and the amount of P uptake compared with the control treatment. These results were probably due to that the used media did not contain enough amount of phosphorus, thus any addition from any fertilizer led to increase the phosphorus content in the leaves of Fuchsia plants. Phosphorus is important as a structural part of many compounds notably, nucleic acids and phospholipids, in addition to its role in energy metabolism (Bidwell, 1974)

Similar results were reported by Kacperska (1985) on Gerbera.

The fertilizer (19:19:19:2) at the highest level (24g/plant) gave the maximum phosphorus content in leaves of Fuchsia plants, compared with the other levels and fertilizers during the two seasons. These results may be attributed to that using enough amount from the suitable fertilizer led to increase the amount of P in the soil, consequently the plants could absorbed high level of it.

Similar results were reported by Tesi *et al*. (1995) on sweet basil.

Potassium content and uptake: Data presented in Table (3) show that using any level from any used fertilizer led to significant increase in the percentage of K in the leaves of Fuchsia plants and the amount of K- uptake compared with the control treatment. These results may be probably due to that the used soil did not contain enough amount of K, consequently any addition from any fertilizer led to increase the amount of available potassium in the soil and the plants absorbed the element and translocated it in its leaves. Potassium is important in respiration, carbohydrate metabolism and overall metabolism of plants (Bidwell, 1974).

Similar trend of results was reported by Tripathi and Sawhney (1989) on sunflower, and Tesi *et al*. (1995) on sweet basil.

Furthermore, the data of the two experimental seasons show that using 10g/plant from the fertilizer (19:6:20:4) gave the maximum percentage of K in the leaves of Fuchsia plants, compared with the other levels and fertilizers. This result was probably due to that using the suitable amount from the suitable fertilizer which had a high ratio of potassium led to increase the percentage of K in the soil and in the leaves.

Similar results were reported by Zile and Gupta (1996) on *Dahlia variabilis* and Lang and Pannkuk, (1998) on Guinea impatiens.

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تأثير الأسمدة المعدنية على نمو وإزهار نباتات الفوكسيا

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قسم الزهور و نباتات الزينة وتنسيق الحدائق، كلية الزراعة جامعة الأسكندرية

أجرى هذا البحث فى مزرعة قسم الزهور ونباتات الزينة وتنسيق الحدائق –كلية الزراعة- جامعة الإسكندرية وذلك خلال الموسمين١٩٩١/١٩٩٢ و١٩٩٢/١٩٩٣ بهدف دراسة تأثير ثلاثة أسمده مركبه بمستويات مختلفة من النتروجين والفسفور والبوتاسيوم والماغنسيوم على النمو الخضرى والزهرى واثر ذلك على المحتوى النتروجينى والفسفورى والبوتاسى فى أوراق نباتات الفوكسيا *Fuchsia hybrida* و كانت الأسمدة المستخدمة هي:-

(١٩: ١٩: ١٩: ٢)، (١٩: ٦: ٢٠: ٤)، (١٣: ٤٠: ١٣: صفر) نتروجين ، فوسفور، بوتاسيوم ، ماغنسيوم على التوالى وقد استخدمت سته مستويات من كل سماد بالإضافة الى معامله المقارنة ، وكانت المستويات على النحو التالى ٤ ،٦ ،٨ ، ١٠، ١٢، ٢٤ جرام/ نبات/موسم.

و قد تم تقسيم كل مستوى الى أربعة أقسام أضيفت للنبات أسبوعيا وكان عدد المعاملات ١٩ معامله فى ثلاث مكررات و كل مكرره اشتملت على ثلاث نباتات بحيث تم زراعة كل نبات فى أصيص قطره ٣٠ سم وكان تصميم التجربة تصميما عشوائيا كاملا. ويمكن تلخيص أهم النتائج المتحصل عليها فى النقاط الاساسيه التاليه:

- أدت أضافه المعاملات السمادية المختلفة الى حدوث تأثيرات معنوية على معظم صفات النمو الخضرى.
- كان أقصى ارتفاع للنبات عند استخدام السماد (١٩- ١٩- ١٩ –٢) بمعدل ٨، ١٠ جرام/نبات فى كلا الموسمين.
- أقصى وزن طازج وجاف للأوراق تم الحصول عليه باستخدام االسماد الأول (١٩- ١٩- ١٩ –٢) بمعدل ١٠، ١٢ جرام/نبات فى كلا الموسمين
- استخدام السماد (١٩-١٩-١٩-٢) وبمعدل ١٠/ ١٢ جرام/نبات أعطى أعلى زيادة معنوية فى الوزن الطازج والجاف للافرع فى كلا الموسمين.
- أظهرت نتائج النمو الزهرى فى الموسمين المتتالين أن استخدام المعاملات السمادية المختلفة أدت الى زياده معنوية فى عدد الأزهار على النبات، وكانت أعلى زيادة معنوية فى عدد الأزهار نتيجة استخدام السماد (١٩-٦-٢٠-٤) بمعدل ١٢ جرام/نبات.

أوضحت نتائج التحليل الكيمائي أن النسبة المئوية للنيتروجين و الفوسفور والبوتاسيوم زادت زيادة معنوية جدا في الأوراق المعاملة بالمعاملات السمادية المختلفة مقارنة بالكنترول.

- استخدام السماد (١٩-٦-٢٠-٤) بمعدل ١٠جرام/نبات أعطى أعلى زيادة معنوية فى النسبة المئوية للنتروجين فى أوراق نبات الفوكسيا فى الموسمين المتتالين.
- استخدام السماد (١٩-١٩-١٩-٢) بمعدل ٢٤جرام/نبات أعطى أعلى زيادة معنوية فى النسبة المئوية للفسفور فى أوراق نبات الفوكسيا فى الموسمين المتتالين.
- استخدام السماد (١٩ –٦-٢٠-٤) بمعدل ١٠ جرام/نبات أعطى أعلى زيادة معنوية فى النسبة المئوية للبوتاسيوم فى أوراق نبات الفوكسيا فى الموسمين المتتالين.
- أعلى معدل امتصاص للعناصر الثلاثة (نتروجين وفوسفور وبوتاسيوم) كانت نتيجة لاستخدام السماد (١٩-٦-٢٠-٤) بمعدل ١٢جرام/نبات فى الموسمين المتتالين.

Table 3: Mean values of nitrogen, phosphorus, potassium contents (%) and uptakes (mg/plant) of a local cultivar of *Fuchsia hybrida* as affected by the different fertilizers (ratios and levels) in the two seasons of 1991/1992 and 1992/1993.

Treatments		Nitrogen content (%)		Nitrogen uptake (mg/plant)		Phosphorus content (%)		Phosphorus uptake (mg/plant)		Potassium content (%)		Potassium uptake (mg/plant)	
Fertilizer Ratios N: P: K: Mg	Levels (g)	First season	Second season	First season	Second season	First season	Second season	First season	Second season	First season	Second season	First season	Second season
19:19:19:02	4.0	1.978	1.946	774.78	706.79	0.348	0.373	136.31	135.47	0.937	0.896	367.02	325.43
	6.0	1.855	2.041	491.20	593.93	0.362	0.369	95.86	107.38	1.141	1.233	302.14	358.80
	8.0	1.542	1.617	526.75	553.98	0.341	0.378	116.49	129.50	1.328	1.148	453.64	393.30
	10.0	2.095	2.042	861.46	805.16	0.341	0.363	140.22	143.13	1.065	1.099	437.93	433.34
	12.0	2.102	2.239	830.71	929.41	0.366	0.352	144.64	146.12	1.417	1.323	560.00	549.18
	24.0	2.082	2.142	742.86	769.62	0.379	0.387	135.23	139.05	1.409	1.178	502.73	423.26
Average		1.942	2.005	704.63	726.48	0.356	0.370	128.13	133.44	1.216	1.146	437.24	413.89
19:06:20:04	4.0	2.141	2.363	645.49	772.94	0.350	0.362	105.5	118.6	1.027	1.033	309.85	337.89
	6.0	1.791	1.573	446.32	410.24	0.340	0.349	86.36	91.19	0.907	0.496	226.02	246.72
	8.0	2.091	2.192	723.07	788.68	0.366	0.343	126.6	124.1	1.107	1.271	393.87	457.31
	10.0	2.455	2.467	689.36	747.25	0.330	0.346	92.58	104.9	1.440	1.335	404.35	404.37
	12.0	1.775	1.681	607.23	642.98	0.344	0.379	117.2	144.9	1.316	1.271	450.20	486.16
	24.0	1.457	2.088	423.70	650.83	0.361	0.366	104.8	114.2	1.379	1.192	401.01	371.15
Average		1.952	2.061	589.27	668.82	0.349	0.358	105.37	115.79	1.196	1.175	364.22	383.93
13:40:13:0	4.0	2.119	2.019	620.87	595.20	0.313	0.364	91.71	107.31	1.220	1.400	357.46	412.72
	6.0	1.618	1.692	380.88	496.36	0.328	0.372	77.21	103.19	1.235	1.118	290.72	310.13
	8.0	1.880	2.021	459.66	597.81	0.366	0.341	89.49	100.87	0.926	1.242	226.41	376.38
	10.0	2.203	2.474	594.81	659.07	0.358	0.366	96.66	97.50	0.957	1.076	258.39	286.65
	12.0	1.400	1.587	384.02	497.37	0.376	0.359	103.14	112.51	1.251	1.312	343.15	411.18
	24.0	2.037	2.228	506.90	648.13	0.341	0.384	80.89	111.71	1.356	1.238	321.64	360.13
Average		1.893	2.004	491.19	577.82	0.347	0.364	89.85	105.52	1.158	1.231	299.63	358.03
Control	0	1.247	1.242	269.98	239.46	0.293	0.304	63.73	58.61	0.709	0.690	153.50	133.03
LSD at $_{0.05}$		0.522	0.392	236.00	190.96	0.030	0.013	25.18	23.31	0.180	0.152	104.4	96.16

LSD at $_{0.05}$: Least significant difference test at 0.05 level of probability.