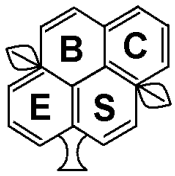

Journal

INFLUENCE OF FOLIAR SPRAY WITH TRYPTOPHAN, PHENYLALANINE, THIAMIN AND ASCORBIC ACID ON GROWTH, YIELD AND VOLATILE OIL CONTENT OF DRAGONHEAD PLANTS

Gomaa, A. O.

Hort. Dept., Fac. Agric., Moshtohor, Benha University, Egypt.

J. Biol. Chem. Environ. Sci., 2008, Vol. 3(1): 259-280 www.acepsag.org

ABSTRACT

This work was carried out at the Experimental Station Faculty of Agriculture at Moshtohor for two successive seasons (2005/2006 & 2006/2007). It was aimed to study the effect of foliar spray with tryptophan, phenylalanine, thiamin and ascorbic acid at concentrations of 50,100 and 150 ppm plus the control on growth, yield and volatile oil content of dragonhead (*Dracocephalum moldavica, L.*) plants. Generally, all tested treatments increased growth parameters, oil yield and chemical constituents: plant height, stem diameter, branches number, fresh and dry weights of branches/plant, leaves number/plant, fresh and dry weights of leaves/plant, yield of fresh leaves/m^2. All treatments also increased root length, fresh and dry weights of roots/plant, leaves oil percentage, leaves oil yield/plant, oil components, total carbohydrates%, carotenoids, chlorophyll (a&b), N%, P% and K% content compared with the control during the two seasons.

Moreover, data cleared that spraying dragonhead plants with tryptophan and phenylalanine at all used concentrations of 50, 100 and 150 ppm. Surpassed vitamin application and improved all studied vegetative growth parameters as well as yield and volatile oil components. The highest mean values concerning all growth, yield, oil content and chemical constituents were obtained by using tryptophan at the highest concentration (150 ppm) comparing with the other treatments or the control plants in both seasons. Results also revealed

that there were significant increase in root growth parameters of dragonhead plants due to spraying plants with amino acids (tryptophan & phenylalanine) followed by thiamin and ascorbic acid application.

Foliar application of amino acids and vitamins at 150 ppm produced the best results of leaves oil percentage, leaves oil yield/plant, oil components, total carbohydrates%, carotenoids, Chlorophylls (a&b), N%, P% and K% content during the two seasons. The highest mean values of leaves oil percentage, leaves oil yield/plant, total nitrogen%, phosphorus%, potassium%, chlorophylls (a&b), carotenoids, carbohydrates% were recorded by spraying dragonhead plants with tryptophan treatments comparing with other treatments or control in both seasons.

Using GLC analysis it was found that Eucalyptol, Nerol, Linalool, Geranial, Citral, Geranyl acetate and Caryophyllene were present as volatile oil constituents. The major constituent of leaves volatile oil of dragonhead plants was (Citral). The highest Citral percentage was obtained by 150 ppm. of ascorbic acid followed by treptophan at 150 ppm. as compared with the other treatments or the control.

Therefore, this study suggest that foliar application of some amino acids i.e., tryptophan and phenylalanine as well as vitamins thiamin and ascorbic acid especially at 150 ppm could play an important role in increasing growth, yield and volatile oils content of leaves of dragonhead (*Dracocephalum moldavica, L.*) plants, added to its safety on human health.

Key words: Dragonhead, tryptophan, phenylalanine, Thiamin, Ascorbic acid, diameter, Branch, yield, Carbohydrates, chlorophylls, Eucalyptol, Nerol, Linalool, Geranial,and Citral.

INTRODUCTION

Dragonhead (*Dracocephalum moldavica, L.*) plants belong to family Labiatae. Also, it is recently introduced to Egypt. It is a hardy plant native to regions from Eastern Europe to Siberia. The plant is widely used in folk medicine as a pain killer and in kidney complains. It is an easy and carefree plant best massed in sunny or partly shaded areas on well drained soil (Ismail, 2007). On the other hand, the plants are easy to grow and require special horticultural practices. Racz *et.al*.

(1978) stated that *Dracocephalum moldavica* is used as painkiller: for treatments of kidney complains, against toothache and colds as well as anti-rheumatism. Chachoyan and Oganesyan (1996) reported that dragonhead plants have been used as anti-tumor. In addition, Ayers *et.al.* (1984) reported that dragonhead plant is very attractive to honey bees and this may reduce their mortality when subjected to pesticide contaminated ground cover.

Amino acids such as tryptophan and Phenylalanine were used in this investigation to increase the percentage of volatile oil in dragonhead plants. Amino acids have been reported one of the most important chemical substances for growth and flowering of plants. Many authors demonstrated that, growth and flowering of many aromatic plants can easily be forced by different amino acids. Mohamed and Wahba (1993) stated that tryptophan at 100 ppm gave the highest oil content of *Rosmarinus officinalis* plants. Gomaa (2001) found that foliar spray with some amino acids of *Antholyza aethiopica* plants increased all tested parameters.

Vitamins have been reported as one of the most important chemical substances for growth and flowering of plants. The role of thiamin in plant biochemistry and physiology it is synthesized in leaves and subsequently translocated to the site of action via the phloem (El-Mansi *et.al.*, 1995) Foliar spray of thiamin increased respiration, catabolism of carbohydrate, enhanced sugar, starch content and C/N ratio in stems, leaves and roots, and also stimulated root development in kidney bean and potatoes (Lijma, 1956). Moreover, root growth stimulation was also reported by Radzevicius and Bluzmanas (1975) when thiamin was applied to tomato plants in water culture. (El-Sherbeny and Hassan, 1987) studied that, spraying *Datura stamonium* with thiamin gave significant increases in plant height, number; fresh and dry weights of leaves, El-khayat (2001) found that, foliar spray with Thiamin, Ascorbic acid treatments increased growth, yield of sepals and chemical contents of *Hibiscus sabdariffa* plant.

Ascorbic acid is known as growth regulating factor that influences many biological processes. Price (1966) reported that, ascorbic acid increased nucleic acid content especially RNA. It also influences the synthesis of enzymes, nucleic acid and protein. It acts as coenzyme in metabolic changes (Patil and Lall, 1973; Reda *et.al*., 1977 and Fadl *et al*., 1977).

The present work aimed to study the effect of foliar spray with tryptophan, phenylalanine, thiamin and ascorbic acid at concentrations of 50,100 and 150 ppm to enhance growth, yield and volatile oil content of dragonhead (*Dracocephalum moldavica, L.*) plants.

MATERIALS AND METHODS

This experiment was carried out at the Experimental Farm, Fac. Agric., Moshtohor Benha Univ., during 2005/2006 and 2006/2007 seasons to study the effect of foliar spray with tryptophan, phenylalanine, thiamin and ascorbic acid at concentrations of 50,100 and 150 ppm plus the control on growth, yield and volatile oil content of dragonhead (*Dracocephalum moldavica, L.*) plants.

Mechanical and chemical analyses of the experimental soil are presented in Tables (1) and (2). Mechanical analysis was estimated according to the methods of Black *et.al.* (1982) whereas, chemical analysis was estimated according to the methods of Jackson (1973).

Table (1): Mechanical analysis of soil sample:

Parameters	Unit	Seasons	
		2005/2006	2006/2007
Coarse sand	%	2.95	3.03
Fine sand	%	18.42	17.22
Silt	%	24.26	23.13
Clay	%	54.37	56.62
Textural class	------	Clay loam	Clay loam

Table (2): Chemical analysis of soil sample:

Parameters	Unit	Seasons	
		2005/2006	2006/2007
$CaCo_3$	%	1.37	1.56
Organic matter	%	1.67	1.82
Total nitrogen	%	0.36	0.40
Total phosphorus	%	0.19	0.21
Total potassium	%	0.22	0.24
E-C	M mhos/cm	0.89	0.93
pH	----------	7.62	7.71

The present work included the following foliar application treatments:

Control (distilled water); tryptophan, phenylalanine thiamin and ascorbic acid each at 50, 100 and 150 ppm. dragonhead (*Dracocephalum moldavica, L.*) plants were treated with three times of the above-mentioned amino acids and vitamins treatments as foliar spray at early morning. The initial application for all treatments was begun after 40 days from planting process; another two successive applications were applied at three weeks intervals.

Cultivation process:

Dragonhead (*Dracocephalum moldavica, L.*) seedlings were individually planted in the first week of October in plots (plot area was one square meter and included two ridges with 50 cm. width). Seeds were sown in hills at 25 cm. apart. Soil was directly irrigated to provide suitable moisture for germination and later thinned at two seedlings per hill.. All the normal culture practices for growing dragonhead plants were followed as recommended by Ismail, (2007).

Sampling and determinations:

At the beginning of flowering stage, the following measurements were recorded; plant height, stem diameter, branches number, fresh and dry weights of branches/plant, leaves number, fresh and dry weights of leaves/plant, yield of fresh leaves/m^2, root length, fresh and dry weights of roots/plant. Added to that, total chlorophyll (a&b) and carotenoides were determined in the fresh leaves of dragonhead plants after one month from the last treatment according to the method described by A.O.A.C. (1980).

The percentage of N,P,K, and Total carbohydrates were determined in the dry leaves at starting of flowering stage, where total nitrogen% were determined using the modified MicroKieldahl method according to A.O.A.C. (1980). Other nutrients (P% and K%) contents were determined after wet diggestion according to the method described by Chapman and Pratt (1961), While total carbohydrates% was determined according to Dubois *et al.* (1956).

At the full blooming time, the following measurements were recorded; leaves oil percentage, leaves oil yield/plant, GLC analysis of leaves oil. The essential oil of each treatment was extracted by hydro-distillation according to Guenther (1961). The GLC analysis of the oil

was carried out using Gas chromatograph, (Hewlett packard GC. Model 5890) equipped with a flame ionization detector (FID). A fused silica capillary (HP-5), (30 m length x 0.53 mm internal diameter (i.d.) x 0.88 um film thickness) , was used for the separation in the GC.

The following are the operating conditions of GC instrument: Injector and detector temperature were 250 and 270 ^{o}C , initial oven temperature, 50 ^{o} C for 2 min., raised at 6 ^{o} C per min, and then hold at 150 ^{o} C for 5 min,. then raised at 5 ^{o} C per min. then hold at 190 ^{o} C the carrier gas was nitrogen at 4 ml per min., and hydrogen, and air were used for the combination at 30 and 300 ml per min., respectively. The identification of the different constituents was achieved by comparing their retention times with those of the authentic samples.

Statistical analysis:

Growth parameters, yield and chemical constituents of the plants were statistically analyzed using the complete randomized block design analysis, revised L.S.D. test according to the procedures outlined by Snedecor and Cochran (1989).

RESULTS AND DISCUSSION

Effect of foliar spray with tryptophan, phenylalanine, thiamin and ascorbic acid on growth parameters of dragonhead plants:

I- Vegetative growth measurements:

I-1- Plant height (cm.):

Data in Table (3) indicate that, all different levels of tryptophan, phenylalanine, thiamin and ascorbic acid increased plant height of dragonhead plants in both seasons as compared with control plant. Generally, increasing tryptophan, phenylalanine, thiamin and ascorbic acid concentrations from 50, 100 up to 150 ppm. produced the highest values as compared to low concentrations. However, the tallest plants were obtained by using the highest concentration of tryptophan (150 ppm.) as it gave 93.33 and 99.66 cm, in the first and second seasons, respectively. On contrary, irrespective control, the lowest mean values of plant height was scored by using ascorbic acid at the lowest concentration (50 ppm.) as it recorded 69.66 and 84.66 cm, in the first and second seasons, respectively. These results are in accordance with the findings of El-Sherbeny and Hassan (1987) on *Datura stramonium,* Khater *et.al.* (1992) on *Tagetes minuta,* Gamal El-Din

et.al. (1997) on lemon-grass plants, El-khayat (2001) on *Hibiscus sabdariffa,* Wahabe *et.al.* (2002) on *Antholyza aethiopica* plants and Balbaa and Talaat (2007) on rosemary plants.

I-2- Stem diameter (cm.):

As shown in Table (3) all tested concentrations of tryptophan, phenylalanine, thiamin and ascorbic acid significantly enhanced the stem diameter of dragonhead plant with the superiority for the high rate. Also, all the tested treatments of tryptophan, phenylalanine statistically increased the stem diameter of dragonhead as compared with control in both seasons with the superiority for the treatment of tryptophan at 150 ppm. in both seasons. Meanwhile, tryptophan at 150 ppm. showed to be the most effective treatment for inducing the highest value of stem diameter as it recorded 1.23 and 1.30 cm. On the reverse, (irrespective control) the lowest value of stem diameter was gained by the treatment of ascorbic acid at 50 ppm which registered 0.73 and 0.90 cm, in the first and second seasons, respectively. These results are in close agreement with the findings of different authors as El-Sherbeny and Hassan (1987) on *Datura stramonium,* El-khayat (2001) on *Hibiscus sabdariffa* and Wahabe *et.al.* (2002) on *Antholyza aethiopica* plants and Balbaa and Talaat (2007) on rosemary plants.

I-3- Branch parameters

Data in Table (3) show that, number, fresh and dry weights of branches/plant were significantly improved by different investigated treatments. Tryptophan treatments gave the highest records of number, fresh and dry weights of branches/plant. Irrespective controls, the lowest records of number, fresh and dry weights of branches/plant were obtained with ascorbic acid at the lowest concentration in both seasons. These results are in agreement with Mohamed *et.al.* (1992) on *Alpinia nutans*, Khater *et.al.* (1992) on *Tagetes minuta*, El-khayat (2001) on *Hibiscus sabdariffa*, Wahabe *et.al.* (2002) on *Antholyza aethiopica* plants and Balbaa and Talaat (2007) on rosemary plants.

I-4- Leaf parameters

Data in Table (4) indicate that, spraying dragonhead plants with tryptophan, phenylalanine, thiamin and ascorbic acid at different concentrations enhanced leaves number, fresh and dry weights of leaves/plant and yield of fresh leaves/m^2. However, the improvements in leaf parameters were in parallel to the applied concentrations.

Table (3): Effect of tryptophan, phenylalanine, thiamin and ascorbic acid on plant height, stem diameter, number, fresh and dry weights of branches/plant of dragonhead plants during 2005/2006 and 2006/2007 seasons

Parameters / Treatments		Plant height (cm.)		Stem diameter (cm.)		Number of branches / plant		Fresh weight of branches /plant (g)		Dry weight of branches /plant (g)	
		2005/2006	2006/2007	2005/2006	2006/2007	2005/2006	2006/2007	2005/2006	2006/2007	2005/2006	2006/2007
Control	0.0	57.66	63.33	0.66	0.83	14.33	15.00	220.00	236.66	30.80	33.13
Tryptophan at	50 ppm	77.33	89.00	0.86	1.06	16.66	17.00	248.33	266.66	32.26	34.66
	100 ppm	88.00	98.66	1.03	1.16	17.00	18.00	268.33	278.33	34.86	36.16
	150 ppm	93.33	99.66	1.23	1.30	17.66	19.66	280.00	293.33	36.36	38.13
Phenylalanine at	50 ppm	75.00	88.33	0.80	1.03	16.00	16.66	243.33	255.00	32.80	33.13
	100 ppm	86.66	96.33	0.96	1.10	16.66	17.33	258.33	268.33	34.86	34.86
	150 ppm	89.33	98.33	1.13	1.26	17.33	18.66	266.66	288.33	35.96	37.46
Thiamin at	50 ppm	73.33	86.66	0.76	0.96	15.66	16.33	236.66	245.00	31.93	33.03
	100 ppm	85.33	94.66	0.86	1.03	16.00	17.33	248.33	261.66	33.46	35.30
	150 ppm	87.33	97.33	1.06	1.23	17.00	17.66	263.33	276.66	35.50	37.33
Ascorbic acid at	50 ppm	69.66	84.66	0.73	0.90	15.33	15.33	235.00	241.66	32.90	32.60
	100 ppm	83.33	91.33	0.76	1.00	16.00	16.00	241.66	255.00	33.83	34.40
	150 ppm	87.66	92.66	0.83	1.06	16.66	17.00	256.66	266.66	35.93	35.96
L.S.D. at 5%		3.08	3.01	0.19	0.09	0.74	2.25	7.39	10.43	1.01	1.39
L.S.D. at 1%		4.18	4.07	0.24	0.12	1.01	3.05	10.01	14.13	1.37	1.88

Table (4): Effect of tryptophan ،phenylalanine, thiamin and ascorbic acid on leaves number, fresh and dry weights of leaves/plant and yield of fresh leaves/ m^2 of dragonhead plants during 2005/2006 and 2006/2007 seasons

Parameters / Treatments		Number of leaves/ plant		Fresh weight of leaves / plant (g)		Dry weight of leaves / plant (g)		Yield of fresh leaves / m2 (g)	
		2005/2006	2006/2007	2005/2006	2006/2007	2005/2006	2006/2007	2005/2006	2006/2007
Control	0.0	516.66	626.66	258.33	313.33	33.56	42.26	1033.33	1253.33
Tryptophan at	50 ppm	690.00	763.33	345.00	381.66	34.5	43.90	1380.00	1526.66
	100 ppm	710.00	793.33	355.00	396.66	35.50	45.60	1420.00	1586.66
	150 ppm	756.66	856.66	378.33	428.33	37.66	49.20	1513.33	1713.33
Phenylalanine at	50 ppm	633.33	710.00	316.66	355.00	31.66	42.60	1266.66	1420.00
	100 ppm	693.33	786.66	346.66	393.33	34.66	47.20	1386.66	1573.33
	150 ppm	753.33	826.66	376.66	413.33	37.66	49.60	1506.66	1653.33
Thiamin at	50 ppm	590.00	686.66	295.00	343.33	32.43	42.90	1180.00	1373.33
	100 ppm	620.00	770.00	310.00	385.00	34.06	48.06	1240.00	1540.00
	150 ppm	706.66	826.66	353.33	413.33	38.83	51.60	1413.33	1653.33
Ascorbic acid at	50 ppm	556.67	670.00	278.33	335.00	33.40	43.53	1213.33	1340.00
	100 ppm	593.33	723.33	296.66	361.66	35.60	47.00	1453.33	1446.66
	150 ppm	635.00	770.00	317.33	385.00	38.06	50.00	1269.33	1540.00
L.S.D. at 5%		25.85	41.98	12.89	20.99	1.48	2.61	140.30	83.96
L.S.D. at 1%		35.04	56.89	17.47	28.44	2.01	3.53	190.20	113.80

So, the highest values of leaf parameters were obtained by using the highest concentrations. Generally, 150 ppm. tryptophan showed to be the most pronounced treatment for producing the highest values of leaves parameters in both seasons. These results are in confirmity with those of El-Sherbeny and Hassan (1987) on *Datura stramonium,* Gomaa (1997) on narcissus plant, Refaat and Naguib (1998) on peppermint plants, Mohamed *et.al.* (1992) on *Alpinia nutans*, Gamal El-Din *et.al.* (1997) on lemon-grass plants, El-khayat (2001) on *Hibiscus sabdariffa*, Wahabe *et.al.* (2002) on *Antholyza aethiopica* plants, Gomaa (2003) on polianthes plants and Balbaa and Talaat (2007) on rosemary plants.

I-5- Root parameters

Data in Table (5) show that, root length, fresh and dry weights of roots/plant were significantly improved by different applied treatments. Irrespective control, the lowest values of root length, fresh and dry weights of roots/plant were obtained in case of ascorbic acid at the lowest concentration (50 ppm.) in both seasons. However, it was interest to observe that there was a positive relation ship between root parameter and the used concentrations of the different tested growth substances in both seasons. So, the gained increase different parameters were parallel to the applied concentration. In general, the highest values of root parameters were scored by using tryptophan at 150 ppm. This trend was true in both seasons. These results are in agreement with those mentioned by Reda *et.al.* (1977)on *Ammi visnaga,* Mohamed *et.al.* (1992) on *Alpinia nutans* plants, El-Mansi *et.al.* (1995) on *Pisum sativum* plants and Balbaa and Talaat (2007) on rosemary plants.

Table (5): Effect of tryptophan ،phenylalanine, thiamin and ascorbic acid on root length ،fresh and dry weights of roots / plant of dragonhead plants during 2005/2006 and 2006/2007 seasons.

Treatments	Parameters	Root length (cm.)		Fresh weight of roots / plant (g)		Dry weight of roots / plant (g)	
		2005/2006	2006/2007	2005/2006	2006/2007	2005/2006	2006/2007
Control	0.0	16.66	17.66	42.66	46.66	7.66	8.36
Tryptophan at	50 ppm	21.66	24.33	54.66	58.33	9.23	9.86
	100 ppm	27.33	28.00	57.00	61.66	9.63	10.43
	150 ppm	31.00	32.66	61.00	67.00	10.33	11.33
Phenylalanine at	50 ppm	19.66	23.33	51.66	56.00	8.23	8.93
	100 ppm	24.66	27.33	54.33	59.00	8.66	9.40
	150 ppm	28.33	30.66	58.33	65.00	9.30	10.36
Thiamin at	50 ppm	18.66	21.66	48.33	53.00	7.66	8.43
	100 ppm	21.33	25.33	50.33	56.33	8.20	8.96
	150 ppm	26.00	28.66	57.00	60.66	9.06	9.66
Ascorbic acid at	50 ppm	17.33	19.66	47.66	51.33	8.03	8.70
	100 ppm	18.66	22.66	49.33	54.00	8.36	9.13
	150 ppm	22.66	25.66	54.00	57.66	9.13	9.73
L.S.D. at 5%		1.68	1.54	1.91	2.01	0.37	0.32
L.S.D. at 1%		2.28	2.09	2.58	2.71	0.50	0.43

II- Leaves oil

II-1- Leaves oil percentage and leaves oil yield / plant:

Data in Table (6) clearly show that, spraying dragonhead plants with tryptophan, phenylalanine, thiamin and ascorbic acid increased leaves oil percentage and leaves oil yield/plant. The highest values of leaves oil percentage and leaves oil yield/plant were obtained with tryptophan at 150 ppm. Irrespective control, the lowest values of leaves oil percentage and leaves oil yield/plant were obtained with ascorbic acid in both seasons. These results are nearly similar with those obtained by Khater *et.al.* (1992) on *Tagetes minuta*, Gomaa (1997) on narcissus plant, Gamal El-Din *et.al.* (1997) on lemon-grass plants, Refaat and Naguib (1998) on peppermint plants, Gomaa (2003) on *Polianthes tuberosa* plants and Balbaa and Talaat (2007) on rosemary plants.

II-2- Gas chromatograms of dragonhead leaves distilled volatile oil:

From data in Tables (6 and 7) and illustrated in Figs (1 to 13) it is clearly observed that GLC analysis of the volatile oil of dragonhead leaves revealed the presence of Eucalyptol, Nerol, Linalool, Geranial, Citral, Geranyl acetate and Caryophyllene in all treatments. However, the main component of dragonhead leaves volatile oil was Citral. The lowest values of Citral was observed in the control treatment as well as the highest recored of Citral was obtained by ascorbic acid at 150 ppm. followed by the treatment of tryptophan at 150 ppm. These results are in accordance with the findings of Halasz *et.al.* (1988) on *Dracocephalum moldavica* plant, Gomaa (1997) on narcissus plant; Refaat and Naguib (1998) on peppermint plants; Lu-Man *et.al.* (1999) on *Dracocephalum heterophyllum* plant and Balbaa and Talaat (2007) on rosemary plants.

III- Chemical composition determinations:

The results of chemical analysis of dragonhead plants as affected by different concentrations of tryptophan, phenylalanine, thiamin and ascorbic acid are shown in Tables (6&8). Data indicated that chemical parameters; total carbohydrates%, carotenoids, chlorophylls (6&8), N. %, P. % and K. % content behaved as the same as that of growth and oil parameters. i.e foliar spraying with tryptophan, phenylalanine,

thiamin and ascorbic acid at different concentrations (50, 100 and 150 ppm) caused an increase in all chemical constituents of dragonhead plants when compared with the control plants in both seasons. Increasing tryptophan, phenylalanine, thiamin and ascorbic acid concentrations up to 150 ppm produced the highest values of measuring parameters. Conclusively, the richest leaf chlorophll (6&8), N%, P% and K% contents was scored by using the highest concentration of tryptophan (150 ppm.) in both seasons. The obtained results are in harmony with those of El-Beheidi *et.al.* (1995) on pea plants, Mohamed *et.al.* (1992) on *Alpinia nutans,* Refaat and Naguib (1998) on peppermint plants, El-khayat (2001) on *Hibiscus sabdariffa*, Gamal El-Din *et.al.* (1997) on lemon-grass plants, Wahabe *et.al.* (2002) on Antholyza aethiopica plants Gomaa (2003) on Polianthes *tuberosa* and Balbaa and Talaat (2007) on rosemary plants.

This study is being of economic importance since; recently the dragonhead plants are more important for export in addition to the widespread of amino acids in many commercial nutrients of farms nowadays in Egypt and other nations. Therefore it can be recommended from the previous results, that foliar application especially tryptophan, phenylalanine, thiamin and ascorbic acid especialy at 150 ppm. plays an important role in improving growth, yield and volatile oil content of dragonhead plants. Therefore, the present study strongly admit the use of such amino acids and vitamins in dragonhed plantation to provide good and high exportion characteristics due to its safty role on human health.

Table (6): Effect of tryptophan ،phenylalanine, thiamin and ascorbic acid on leaves oil percentage ، leaves oil yield / plant, total carbohydrats% and carotenoids of dragonhead plants during 2005/2006 and 2006/2007 seasons.

Parameters / Treatments		Leaves oil %		Leaves oil yield/plant		Total carbohydrates %		Carotenoids mg/g (f.w.)	
		2005/2006	2006/2007	2005/2006	2006/2007	2005/2006	2006/2007	2005/2006	2006/2007
Control	0.0	0.207	0.207	0.530	0.647	18.000	18.667	0.597	0.590
Tryptophan at	50 ppm	0.223	0.243	0.777	0.927	20.667	21.333	0.757	0.740
	100 ppm	0.237	0.257	0.837	1.013	23.000	22.667	0.783	0.783
	150 ppm	0.247	0.287	0.927	1.227	23.333	23.333	0.797	0.793
Phenylalanine at	50 ppm	0.217	0.230	0.683	0.813	20.333	20.667	0.707	0.723
	100 ppm	0.227	0.247	0.783	0.963	22.000	22.333	0.777	0.750
	150 ppm	0.237	0.267	0.890	1.100	22.667	23.333	0.793	0.777
Thiamin at	50 ppm	0.217	0.227	0.633	0.773	19.667	20.667	0.697	0.677
	100 ppm	0.220	0.240	0.680	0.917	21.000	21.333	0.753	0.713
	150 ppm	0.227	0.253	0.797	1.037	22.667	22.000	0.783	0.757
Ascorbic acid at	50 ppm	0.207	0.217	0.570	0.720	18.667	19.667	0.623	0.613
	100 ppm	0.210	0.220	0.617	0.793	20.333	20.333	0.683	0.673
	150 ppm	0.213	0.230	0.673	0.883	21.333	22.000	0.680	0.707
L.S.D. at 5%		0.005	0.005	0.053	0.106	2.058	1.952	0.053	0.005
L.S.D. at 1%		0.007	0.007	0.072	0.144	2.789	2.646	0.072	0.007

Table (7): Effect of tryptophan, phenylalanine, thiamin and ascorbic acid on the identified constituents of leaves dragonhead plants of volatile oil obtained from G.L.C. analysis and calculated as relative percentages.

parameters / Treatments		Area %							
		Eucalyptol	Nerol	Linalod	Geranial	Citral	Geranyl acetate	Caryophyllene	Total components
Control	0.0	0.53655	6.21331	6.48419	4.38865	18.26493	8.67110	2.53944	47.09817
Tryptophan at	50 ppm	2.74549	2.68772	7.69859	14.22317	61.55820	3.05758	1.67339	93.64414
	100 ppm	0.59652	2.11024	0.99998	10.93525	54.33178	29.06993	0.21727	98.26097
	150 ppm	0.42195	5.13760	1.69859	6.57733	72.20921	12.02210	0.60106	98.66784
Phenylalanine at	50 ppm	0.60820	2.06594	2.15722	42.32591	32.03578	12.41696	0.95552	92.56553
	100 ppm	0.17010	2.76351	1.72201	18.18875	47.60007	26.65851	0.51015	97.61310
	150 ppm	0.54853	2.24369	0.70727	9.37015	51.04204	33.90211	0.62397	98.43776
Thiamin at	50 ppm	0.34892	8.14065	1.97698	14.37488	28.38069	25.45289	0.53117	79.20618
	100 ppm	0.09784	2.13277	1.44063	17.53655	46.82097	27.92421	0.65197	96.60487
	150 ppm	0.45525	12.67649	9.37068	17.95195	25.74259	23.39022	1.44725	91.03443
Ascorbic acid at	50 ppm	1.71430	6.40422	5.27834	8.19933	25.23013	23.63344	2.14384	72.6036
	100 ppm	0.16011	4.33455	7.22373	16.98316	45.30369	19.46210	0.10976	93.57710
	150 ppm	0.75881	5.15339	0.92126	5.48886	74.33065	11.03842	0.59837	98.28976

Table (8): Effect of tryptophan ،phenylalanine, thiamin and ascorbic acid on chlorophyll (a&b), N%, P% and K %of dragonhead plants during 2005/2006 and 2006/2007 seasons

Parameters / Treatments		Chlorophyll (a) mg/g (f.w.)		Chlorophyll (b) mg/g (f.w.)		N%		P%		K%	
		2005/2006	2006/2007	2005/2006	2006/2007	2005/2006	2006/2007	2005/2006	2006/2007	2005/2006	2006/2007
Control	0.0	1.377	1.447	0.403	0.417	1.193	1.227	0.387	0.410	1.110	1.190
Tryptophan at	50 ppm	1.503	1.517	0.463	0.460	1.310	1.417	0.487	0.507	1.197	1.310
	100 ppm	1.590	1.597	0.500	0.500	1.377	1.507	0.523	0.590	1.267	1.467
	150 ppm	1.663	1.670	0.597	0.577	1.480	1.673	0.607	0.650	1.360	1.580
Phenylalanine at	50 ppm	1.483	1.493	0.457	0.457	1.280	1.370	0.417	0.473	1.187	1.240
	100 ppm	1.547	1.513	0.477	0.473	1.317	1.450	0.457	0.550	1.237	1.420
	150 ppm	1.620	1.627	0.570	0.523	1.430	1.597	0.567	0.583	1.320	1.533
Thiamin at	50 ppm	1.467	1.487	0.437	0.447	1.253	1.330	0.407	0.460	1.160	1.227
	100 ppm	1.490	1.513	0.453	0.457	1.300	1.393	0.440	0.493	1.207	1.410
	150 ppm	1.577	1.610	0.533	0.513	1.367	1.463	0.557	0.547	1.277	1.490
Ascorbic acid at	50 ppm	1.447	1.473	0.430	0.437	1.213	1.300	0.403	0.440	1.143	1.210
	100 ppm	1.483	1.500	0.443	0.457	1.287	1.353	0.483	0.477	1.183	1.383
	150 ppm	1.553	1.567	0.490	0.490	1.317	1.450	0.513	0.523	1.253	1.440
L.S.D. at 5%		0.005	0.053	0.005	0.005	0.053	0.053	0.053	0.053	0.005	0.005
L.S.D. at 1%		0.007	0.072	0.007	0.007	0.072	0.072	0.072	0.072	0.007	0.007

Gas chromatograms of dragonhead leaves distilled volatileoil as influenced by tryptophan, phenylalanine, thiamin and ascorbic acid foliar application

1- Eucalyptol
2- Nerol
3- Linalool
4- Geranial
5- Citral
6- Geranyl acetate
7- Caryophyllene

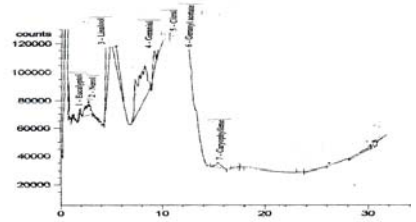

Fig (1): Gas chromatograms of dragonhead leaves volatile distilled of untreated plants (control)

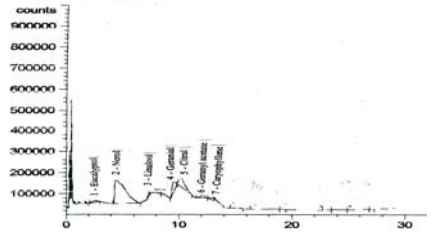

Fig (2): Gas chromatograms of dragonhead leaves volatile distilled of 50 ppm tryptophan treated plants

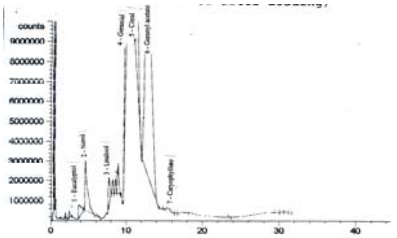

Fig (3): Gas chromatograms of dragonhead leaves volatile distilled of 100 ppm tryptophan treated plants

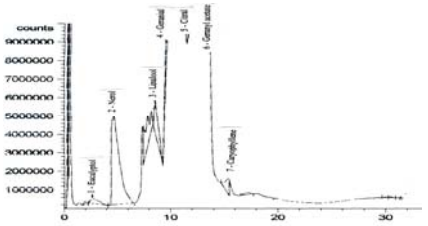

Fig (4): Gas chromatograms of dragonhead leaves volatile distilled of 150 ppm tryptophan treated plants

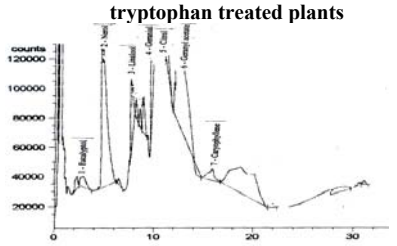

Fig (5): Gas chromatograms of dragonhead leaves volatile distilled of 50 ppm phenylalanine treated plants

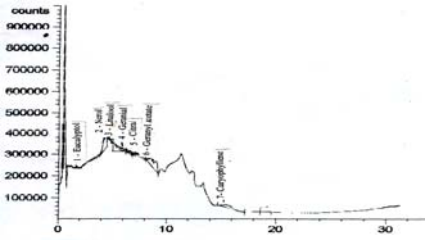

Fig (6): Gas chromatograms of dragonhead leaves volatile distilled of 100 ppm phenylalanine treated plants

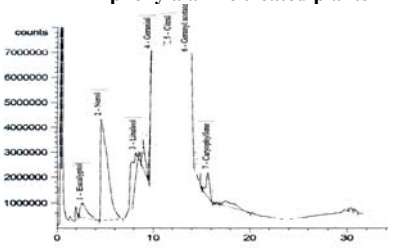

Fig (7): Gas chromatograms of dragonhead leaves volatile distilled of 150 ppm phenylalanine treated plants

Gas chromatograms of dragonhead leaves distilled volatile oil as influenced by tryptophan, phenylalanine, thiamin and ascorbic acid foliar application

1- Eucalyptol
2- Nerol
3- Linalool
4- Geranial
5- Citral
6- Geranyl acetate
7- Caryophyllene

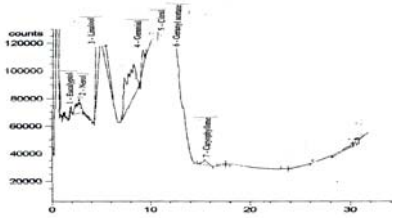

Fig (1): Gas chromatograms of dragonhead leaves volatile distilled of untreated plants (control)

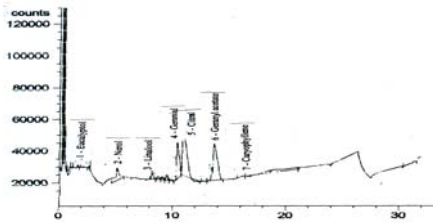

Fig (8): Gas chromatograms of dragonhead leaves volatile distilled of 50 ppm thiamin treated plants

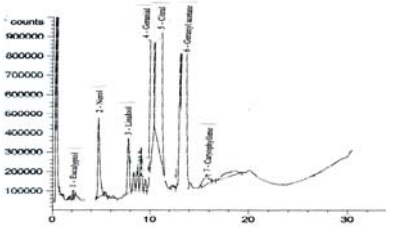

Fig (9):Gas chromatograms of dragonhead leaves volatile distilled of 100 ppm thiamin treated plants

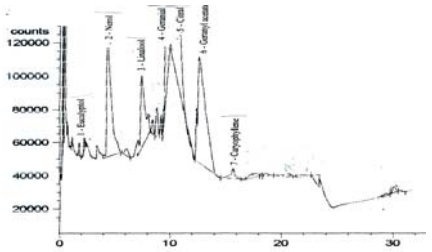

Fig (10): Gas chromatograms of dragonhead leaves volatile distilled of 150 ppm thiamin treated plants

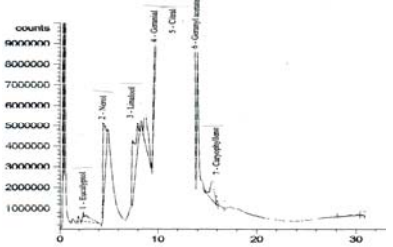

Fig (11):Gas chromatograms of dragonhead leaves volatile distilled of 50 ppm Ascorbic acid treated plants

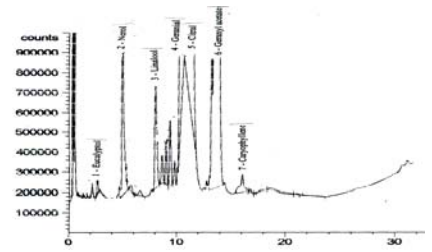

Fig (12):Gas chromatograms of dragonhead leaves volatile distilled of 100 ppm Ascorbic acid treated plants

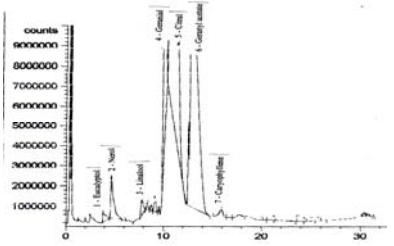

Fig (13):Gas chromatograms of dragonhead leaves volatile distilled of 150 ppm Ascorbic acid treated plants

REFERENCES

A.O.A.C.(1980). Official Methods of Analysis,12Th Ed. Association of official analysis chemists :Washington , D.C., U.S.A.

Ayers, G.S.; Hoopingarner, R.A. and Howitt, A.J. (1984). Diversionary planting for reduction of pesticide related bee mortality. American, Bee, Journal, 124: 360-362; 450-453; 514-516;B.

Balbaa, L.K. and Talaat, I.M. (2007). Physiological response of rosemary plants (*Rosmarinus officinalis*, L.) to ascorbic acid, phenylalanine and ornithine.Egypt. J. of Appl. Sci., 22 (IIB) 375-385.

Black, C.A., Evans, D.O.; Ensminger, LE.; White, J.L.; Clark, F.E. and Dinauer, R.C. (1982). Methods of Soil Analysis. part 2. Chemical and microbiological properties. 2nd Ed. Soil Sci.,Soc. of Am. Inc. Publ., Madison, Wisconsin, U. S.A.

Chachoyan, A.A. and Oganesyan, G.B.(1996). Anti-tumor of some species of family Lamiaceae. Rastitel 32 (4): 59-64.

Chapman, H.D. and Pratt, P.F. (1961). Methods of Soil, Plants and Water Analysis. Univ. of California, Division of Agricultural Sciences.

Dubois, M.; Smith, F.; Gilles, K.A.; Hamilton, K. and Rebers, P.A. (1956). Colorimetric method for determination of sugars and related substances. Annal. Chem., 28 (3): 350-356.

El-Beheidi, M. A. ; El-Mansi, A. A.; Metwally, A. M.; Guirgis, A. A. and Swidan, S. A. (1995). Effect of nitrogen sources and vitamin B1 on growth and yield of pea plants. Annals of Agric. Sc., Moshtohor, 33 (4), pp 1481-1495.

El-khayat, A.S.M., (2001). Physiological effects of tryptophane, thiamin and ascorbic acid on *Hibiscus sabdariffa, L.* plant. The Fifth Arabian Horticulture Conference, Ismailia, Egypt, March 24-28, Vol. II. p. 251-264.

El-Mansi, A.A.; El-Beheidi, M. A. ; Guirgis, A.A.; Metwally, A.M. and Swidan, S.A. (1995). Biochemical and root system response to nitrogen sources and vitamin B1 in *Pisum sativum*. Annals of Agric. Sc., Moshtohor, 33 (4) : 1465-1480.

El-Sherbeny, S.E. and Hassan, A.E. (1987). Physiological studies on *Datura stramonium* L. the effect of some alkaloid percursors on

growth, chemical composition and leaf alkaloids. Bull. N.R.C., Egypt 12: 101-110.

Fadl, M. F.; Reda, R. S.; Abdel-All and El-Moursi, A. (1977). Physiological studies on *Ammi visnaga*. Egypt. J. Physiol. Sci, 5 ; 73-83.

Gamal El-Din, K.M.; Tarraf, S.A. and Balbaa, L.K. (1997). Physiological studies on the effect of some amino acids and micronutrients on growth and essential oil content in lemon-grass (*Cymbopogon citrates*, Hort.).J. Agric., Sci., Mansoura Univ., 22 (12): 4229-4240.

Gomaa, A. O., (2001). Effect of foliar spray with some amino acids and nutrient elements on *Antholyza aethiopica,* L. plants. The Fifth Arabian Horticulture Conference, Ismailia, Egypt, March 24-28, Vol. II. p. 63-76 .

Gomaa, A. O., (2003). Effect of foliar application with some amino acids and vitamins on growth, flowering and chemical constituents of two members of the amarylidaceae family. 1- Polianthes tuberosa *cv double plants. Egypt. J. Sci., 18 (6B): 719-735.*

Gomaa, A.O. (1997). Physiological studies on narcissus plant (*Narcissus tazetta*). Ph. D. Thesis Fac. of Agric. Moshtohor, Zagazig Univ. Egypt.

Guenther, E. (1961). " The Essential Oils ". 4th ed., Vol. four. D. Van Nostrand company, Inc., Princeton, New Jersey.

Halasz, Z.K.; Hornok, L. and Domokos, J. (1988). Data on the cultivation of *Dracocephalum moldavica,* L. in Hungary. Herba Hungarica, 27 (1): 49-58.

Ismail, S.E. (2007). Comparison study between bio and mineral fertilization of dragonhead plant on yield and volatile oil. Ph. D. Thesis, Fac. Agric. Moshtohor Benha Univ. Egypt.

Jackson, M.L.(1973). Soil Chemical Analysis. Prentice-Hall of Indian Private, New Delhi.

Khater, M.R.; Abo zeid, M.H. and Awaad, K.A. (1992). Effect of foliar spray of thiamin (vitamin Bi) on vegetative growth and volatile oil of *Tagetes minuta* L. Ann. Agric. Sc., Moshtohor, 30 (4), pp 1883-1888.

Lijma, T. (1956). On the physiology and utilization of vitamin B1 in garden crops, VII. The effects of foliage thiamin sprays on the

chemical composition of taste of some garden crops Ibil. 25:194-198.

Lu-Man, L.A.; Tian-Xuan, A.D; Lu-M, F.S. and Tian-X, S.H. (1999). Analysis of essential oil of *Dracocephalum heterophyllum* Benth. Acta Pharmaceutica Sinica. 34 (12): 925-927.

Mohamed, S.M. and Wahba, H.E. (1993). Response of growth ,oil percentage and oil constituents of *Rosmarinus officinalis L*. to application of some growth substances. Egypt Ann. Agric. Sc.,Moshtohor, 31 (3):pp 1614-1625.

Mohamed, S.M., Wahba, H.E. and Omer, E.A. (1992). Effect of some growth regulators on the growth, oil percentage and constituents of *Alpinia nutans*,(Hort). Egypt Ann. Agric. Sc., Moshtohor, 30 (3):pp 1501-1513 .

Patil, B. N. and Lall, S. B. (1973). Effect of presowing treatment with L-ascorbic acid and gibberelic acid on growth and physiological constituents wheat Botanique (Nagpur) , 4, 5770 (Biol. Abst. 57:34).

Price, C. E. (1966). Ascorbic stimulation of RNA synthesis. Nature 212, 1481.

Racz, G.; Tibori, G. and Csedo, C. (1978). Composition of volatile oil from *Dracocephalum moldavica, L.* Farmacia, 26 (2): 93-96.

Radzevicius, A. and Bluzmanas, P. (1975). The effect of thiamin and nicotinic acid on some physiological processes in tomato Nauchnye trudy vysshikh uchebnykh zavedenit lit SSR, Biologiya 14. 70-74 (C.F. Hort. Abst. 46 (10) 9414).

Reda, F.M.; Fadl, R.S.; Abdel-All and El-Moursi, A. (1977). Studies on *Ammi visnaga* L. The effect of thiamin and ascorbic acid on growth and chromone yield.Egypt. J.farm Sci,18;19-27.

Refaat, A.M. and Naguib, N.Y. (1998). Peppermint yield and oil quality as affected by application of some amino acids. Bull., Fac., Agric., Univ., Cairo, 49 : 89-98.

Snedecor, G.W. and Cochran, W.G. (1989). Statistical methods. 8th Ed., Iowa State Univ., Press, Iowa ,U.S.A.

Wahabe, H.E.; Mohamed, S.M.; Attoa, G.E. and Frahat, A. (2002). Response of *Antholyza aethiopica,* to foliar spray with some amino acids and mineral nutrition with sulphur. Annals Agric. Sci., Ain Shams Univ., Cairo, 47 (3): 929-944.

تأثير الرش بالتربتوفان والفينايل آلانين والثيامين وحمض الاسكوربيك علي النمو والمحصول والزيت الطيار لنباتات رأس التنين

أنور عثمان جمعة
قسم البساتين - كلية الزراعة بمشتهر- جامعة بنها

أجريت هذه الدراسة بمزرعة كلية الزراعة بمشتهر قسم البساتين فرع الزينة خلال الموسمين الزراعيين 2006/2005 و 2007/2006 لدراسة تأثير الرش بالتربتوفان والفينايل آلانين والثيامين وحمض الاسكوربيك بتركيزات 50، 100، 150 جزء في المليون لكل منهم علاوة علي معاملة الكنترول علي النمو والمحصول والزيت الطيار ومكوناتة لنبات رأس التنين حيث أوضحت النتائج ما يلي:

أعطت كل المعاملات تحت الدراسة زيادة في صفات النمو المدروسة ومحصول الزيت الطيار ومكوناتة وتشمل طول النبات وقطر الساق وعدد الأفرع والوزن الطازج والجاف للأفرع والأوراق/ نبات مقارنة بنباتات الكنترول. كما أدت جميع المعاملات إلي زيادة طول الجذر والوزن الطازج والجاف للجذور/نبات مع زيادة النسبة المئوية للزيت ومحصول الزيت الكلي/نبات كما زادت مكونات الزيت الطيار ونسبة الكربوهيدرات الكلية والكاروتينيدات والكلوروفيل ونسبة النيتروجين والفوسفور والبوتاسيوم بالمقارنة بنباتات الكنترول خلال موسمي التجربة.

كما أظهرت النتائج أن معاملات الرش بالأحماض الأمينية (التربتوفان & الفينايل آلانين) بالتركيزات المستخدمة (50، 100، 150 جزء في المليون) تفوقاً علي معاملات الرش بالفيتامينات (الثيامين & الاسكوربيك) حيث أدت إلي زيادة صفات النمو الخضري والمحصول والزيت الطيار ومكوناتة. وكانت أعلي المعاملات من حيث النمو والمحصول ومحتوي الزيت الطيار والتركيب الكيماوي عند الرش بالتربتوفان بتركيز 150 جزء في المليون وذلك بالمقارنة بباقي المعاملات أو الكنترول في كلا الموسمين. كما حسنت معاملات الأحماض الأمينية (التربتوفان & الفينايل آلانين) وأيضا الفيتامينات (الثيامين & الاسكوربيك) طول المجموع الجذري والوزن الطازج والجاف للمجموع الجذري بالمقارنة بنباتات الكنترول.

كما أدت معاملات الرش بالأحماض الأمينية والفيتامينات بتركيز 150 جزء في المليون إلي الحصول علي أفضل النتائج من حيث نسبة الزيت الطيار في الأوراق ومحصول الزيت للنبات ومكونات الزيت وأيضاً ونسبة الكربوهيدرات الكلية والكاروتينيدات والكلوروفيل ونسبة النيتروجين والفوسفور والبوتاسيوم بالمقارنة خلال موسمي التجربة وكانت أعلي متوسطات لنسبة الزيت بالأوراق ومحصول الزيت الطيار للنبات ونسبة النيتروجين والفوسفور والبوتاسيوم والكربوهيدرات الكلية والكاروتينيدات والكلوروفيل أمكن الحصول عليها عند الرش بالتربتوفان بالمقارنة بباقي المعاملات والكنترول في كلا الموسمين.

كما أظهر التحليل الكروماتوجرافي للزيت الطيار أنة يحتوي علي المكونات التالية (Eucalyptol, Nerol, Linalool, Geranial, Citral, Geranyl acetate and Caryophyllene) وكان المكون الرئيسي للزيت الطيار بالأوراق هو مركب السترال (Citral) وكانت أعلي نسبة مئوية لمركب السترال (Citral) في الزيت نتيجة الرش بحامض الآسكوربيك والتربتوفان بمعدل 150 جزء في المليون لكل منهما بالمقارنة بباقي المعاملات ونباتات الكنترول.

بناء علي نتائج هذه الدراسة ، فإنة يفضل رش نباتات رأس التنين ذات الأهمية الاقتصادية والطبية بالأحماض الأمينية (التربتوفان & الفينايل آلانين) وأيضا الفيتامينات (الثيامين & الاسكوربيك) خاصة التركيزات العالية (150 جزء في المليون) حيث أنها أكثر أماناً لصحة الإنسان وتحسين نمو وإنتاجية نباتات رأس التنين.