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The Role of Amino Acids, Potassium and Selenium in Improving Growth of *Eucalyptus citriodora* Hook Plants and their Tolerance to Forest

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ABSTRACT

This study was undertaken in the open field at the nursery of Hort. Res. Inst., ARC, Giza, Egypt during the winter of 2016/2017 and 2017/2018 seasons to find out the effect of some fertilization treatments, which were: foliar spraying with aqueous solution of amino acids mixture at the rate of 1 g/l (T1), T1 + soil drenching with potassium sulphate (K_2SO_4) at 2 g/plant (T2), T1 + sodium selenate (Na_2SeO_4) as foliar spray at 1 g/l (T3), T2 + Na_2SeO_4 as foliar spray at 1 g/l (T4) and foliar spray with tap water only (as control) on growth, chemical composition and tolerance of one-year-old seedlings of *Eucalyptus citriodora* Hook. grown in 25-cm-diameter plastic pots filled with about 4 kg of sand + clay soil mixture (1:1, by volume) to winter months. The treatments were applied 2 times every month in a complete randomized design. The obtained results showed that means of the different growth parameters; expressed as: plant height, stem diameter, No. leaves/plant, root length, as well as fresh and dry weights of stem, leaves and roots were significantly increased as a result of applying the various treatments mentioned above relative to control means in the two seasons. However, the dominance was for the sole treatment of amino acids (T1) that gave the highest values over the combined treatments in both seasons. A similar trend was also obtained regarding the leaf content of chlorophyll a, b, carotenoids, total soluble sugars and total carbohydrates, as T1 treatment attained the highest records of such constituents, with few exceptions. However, the opposite was the right concerning the leaf content of N, P and K, where N % slightly decreased by T1 treatment, but increased to maximum by T2 one. As for P and K % recorded the highest by T4 treatment. Hence, it is enough to spray the foliage of *E. citriodora* plants cultivated in 25-cm-diameter plastic pots with the aqueous solution of amino acids mixture at the rate of 1 g/l, once every 15 days in winter months for keeping well growth and better quality plants.

Keywords: *Eucalyptus citriodora*, fertilization treatments, amino acids, potassium sulphate, sodium selenate.

INTRODUCTION

The lemon-scented spotted gum (*Eucalyptus citriodora* Hook) is an evergreen tall tree, up to 45 m high, belongs to Fam. Myrtaceae and native to Australia. It is cultured on canals, agricultural roads, avenues, green belts and also grown for shading, erosion prevention and for wind breaking. It furnishes a valuable timber that used for fuel and wood industries (Bailey, 1976; El-Hadidi and Boulos, 1979). Sran *et al*., (2018) mentioned that Eucalyptus hybrid trees are very suitable for phytoremediation due to its fast growth and having a large tissue. In green house study on 3 species of Eucalyptus (*E. dunnii*, *E. grandis* and *E. pellita*) subjected to 3 different temperature regimes (10, 20 and 30 °C), Mokochinski *et al*., (2018) found that the leaf chlorophyll content was positively correlated to temperature and in *E. pellita*, the highest temperature also resulted in a significant increase in stem biomass. Moreover, soluble sugars and several polyphenols, including tannins, triterpens and alkaloids were mostly influenced. On a drought-tolerant *Eucalyptus globulus* clone, Correia *et al*., (2018) discovered that heat increased the relative water content and pre-dawn water potential, but photosynthetic rate and pigments were reduced accompanied by a reduction in water use efficiency. Sugar alcohols and several amino acids were enhanced by the heat, while starch, fructose-6-phosphate, glucose-6-phosphate and a –glycerphosphate were reduced.

Amino acids are organic nitrogen compounds act as antioxidants in higher plants. They are responsible of protein synthesis through the process in which ribosome catalyse the polymerization of amino acids (Smith, 1982). They can affect plant growth via their influence on IAA and GA biosynthesis (Walter and Nawacki, 1987). The beneficial effects of amino acids on growth and chemical composition of some ornamental plants were detected before by El-Fawakhry and El-Tayeb (2003) on chrysanthemum, Abd El-Aziz *et al*., (2009) on *Antirrhinum majus*, El-Nagar *et al*., (2013) on *Lilium longiflorum*, Moustafa and Ebeid (2013) on *Albizzia lebbek* and *Taxodium distichum*, Hashish *et al*., (2015) on gladiolus and Khan *et al*., (2018) who revealed that pre-harvest foliar spray of amino acids and seaweed significantly increased plant height, number of leaves, leaf area, yield per plant, number of marketable fruits per plant, average fruit diameter, fruit wall thickness and average single fruit weight of bell pepper cvs. "Seven R2F1" and "Red Knight". They also improved postharvest physicochemical quality of both cvs. under extended cold storage conditions.

Selenium (Se) is a trace essential element, which can regulate the water status and can also increase the tolerance of plants to environmental and UV-induced oxidative stresses, delay senescence and promote the growth of ageing young plants (Germ and Stibilj, 2007). It is effectively used for bio-fortification of crops, hence fortifying food/feed to mitigate Se deficiency in humans, livestock and plants. It is a common ingredient in some insecticides, fungicides and in premix animal feed (Kamburov *et al*., 2014). At low levels, Se tended to stimulate the plant growth and root elongation, but at higher ones, the opposite is the right. In this concern, Abdel-Fattah (2014) reported that treatment of *Jacaranda acutifolia* seedlings grown in saline soil with both Fe_3O_4 (4 g/seedling) and Na_2SeO_4 (2 ppm as foliar spray) gave the tallest plants, the longest root, the highest No. leaves and the heaviest fresh and dry weights of aerial parts and roots. Such interaction also improved the contents of pigments, N, P, K and proline in the leaves. Likewise, were those results obtained by Saffaryazdi *et al*., (2012) on spinach, Abd El-All *et al*., (2013) on squash, Aghighi *et al*., (2018) on *Stevia rebaudiana*, Haibin *et al*., (2018) on tea and JuanJuan and HaiJun (2018) on wine grape.

Yet, several studies affirmed that potassium (K) is one of the important macronutrients, necessary for the accumulation of food reserves and maintaining the optimum growth and quality of crops (Garaie *et al*., 2016). It affects stomatal movement, regulating photosynthesis, respiratory rates and activating many enzymatic systems included in plant growth. It also enhances translocation of sugars through plant organs, increases protein synthesis and reduces respiration, preventing energy loss (Csizinsky, 1999). In this regard, Tawila (2018) elicited that K_2SO_4 at either 2 or 3 g/pot improved root length, fresh and dry weight of *Celosia cristata* plants, caused a significant flowering precocity, improved No. inflorescences/plant, inflorescence diameter, flowering stalk length and diameter and leaf contents of chlorophyllous pigments, N, P, K and total carbohydrates. Similar responses were also explored by El-Shakhs *et al*., (2002) on *Dahlia pinnata*, Shahin *et al*., (2006) on *Rudbeckia hirta*, Michalojc (2007) on *Gomphrena globosa*, Li *et al*., (2013) on *Datura arborea* and Garaie *et al*., (2016) on *Catharanthus roseus*.

This work, however was undertaken aiming to reveal the role of amino acids, solely or combining with potassium sulphate and sodium selenate in improving growth of *E. citriodora* (Kafur limoumi) plants and enhancing their tolerance to cold.

MATERIALS AND METHODS

An investigation was conducted in the open field at the nursery of Hort. Res. Inst., ARC, Giza, Egypt throughout 2016/2017 and 2017/2018 seasons in order to examine the effect of either individual application of amino acids or connecting with K_2SO_4 and Na_2SeO_4 on growth and quality of *E. citriodora* plants during the winter months.

So, one-year-old seedlings of lemon-scented spotted gum (*Eucalyptus citriodora* Hook) were selected to be uniform as possible (about 30 cm height with 5-6 leaves) and transplanted on mid of October for every season in 25-cm-diameter plastic pots (one seedling/pot) filled with about 4 kg of an equal mixture prepared from sand and clay. The physical and chemical properties of both sand and clay used in both seasons were evaluated and listed in Table (a).

Table a. The physical and chemical properties of the sand and clay used in 2016/2017 and 2017/2018 seasons.

Seasons	Soil type	Particle size distribution (%): Coarse sand	Fine sand	Silt	Clay	S.P.	E.C. (dS/m)	pH	Cations (meq/l): Ca^{++}	Mg^{++}	Na^{+}	K^{+}	Anions (Meq/l): HCO_3^-	Cl^-	SO_4^{--}
2016/	Sand	89.03	2.05	0.40	8.52	23.01	3.56	7.9	7.50	1.63	33.6	0.50	3.20	22.00	18.03
2017	Clay	7.54	22.28	30.55	39.63	55.00	2.21	8.0	7.82	2.12	15.4	0.75	6.60	8.20	11.29
2017/	Sand	84.76	6.30	1.49	7.45	21.87	3.78	7.9	19.42	8.33	7.2	0.75	1.60	7.80	26.30
2018	Clay	7.64	22.50	30.15	39.71	52.38	2.34	8.1	7.50	2.20	15.5	0.75	6.78	8.02	11.15

After one month from planting (on November, 15th), the seedlings received the following treatments:

1. No fertilization (as the foliage was sprayed with tap water only) referred to as control.
2. Spraying the foliage with an aqueous solution of amino acid mixture at the rate of 1 g/l (T1) till the solution was run-off. The composition of amino acid mixture used in the two seasons are shown in Table (b).
3. T1 + drenching the soil mixture with potassium sulphate (K_2SO_4, 48.5 % K_2O) at the rate of 2 g/plant (T2).
4. T1 + foliar spraying with the aqueous solution of sodium selenate (Na_2SeO_4) at the rate of 1 g/l (T3).
5. T1 + drenching the soil mixture with K_2SO_4 (2g/plant) + foliar spray with the aqueous solution of Na_2SeO_4 (1 g/l) (T4).

Table b. The composition of amino acids mixture used in the two seasons.

Amino acid	Value (%)	Amino acid	Value (%)	Amino acid	Value (%)
Alanime	2.26	Histidine	0.56	Serine	4.99
Arginine	4.64	Leucine	2.03	Threonine	3.57
Aspartic	3.29	Lysine	1.75	Tryptophan	1.25
Glutamic	8.18	Phenylalanine	0.99	Tyrosine	0.52
Glycine	2.03	Proline	3.96	Valine	2.51

The previous treatments were twice applied every month till the end of the experiment on April, 15th. The layout of the experiment in both seasons was a complete randomized design, with three replicates, as each one contained five plants (Mead et al., 1993). Irrigation and all the other agricultural practices were carried out whenever needed, as usually grower did. The atmospheric conditions during the course of this study are obtained from the Agrometeorological Station of Giza and Exhibited in Table (c).

Table c. Monthly average of air and soil temperatures and relative humidity during the two seasons.

Month	2016/2017: Air temperature (°c)	Soil temperature (°c)	Relative humidity (%)	2017/2018: Air temperature (°c)	Soil temperature (°c)	Relative humidity (%)
October	23.29	27.17	57.35	22.83	26.23	56.21
November	20.82	23.61	65.27	20.41	23.15	63.97
December	14.37	17.35	68.52	14.08	17.00	67.16
January	14.98	16.45	72.54	14.70	16.21	71.08
February	16.39	18.35	67.39	16.10	17.95	66.05
March	21.35	23.17	67.50	20.97	22.71	67.00
April	24.50	26.79	58.33	24.03	26.25	57.15

At the end of each season (on mid of April), data were recorded as follows: plant height (cm), stem diameter (cm), number of leaves/plant, root length (cm) as well as fresh and dry weights of stem, leaves and roots (g). In fresh leaf samples taken from the middle parts of the plants in the 2nd season only, photosynthetic pigments content (chlorophyll a, b and carotenoids, mg/g f.w.) was measured by the quick method described by Yadava (1986), while in dry ones, the percentages of total soluble sugars (Dubois *et al*., 1966), total carbohydrates (Herbert *et al*., 1971), nitrogen (Black, 1956), phosphorus (Luatanab and Olsen, 1965) and potassium (Page *et al*., 1982) were assessed.

Data were then tabulated and the only morphological ones were statistically analyzed using SAS Institute program (2009), followed Duncan's New Multiple Range Test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

- Effect of fertilization treatments on:

1- Vegetative and root growth traits:

It is evident from data presented in Tables (1 and 2) that means of plant height (cm), stem diameter (cm), number of leaves/plant, root length (cm) as well as fresh and dry weights of stem, leaves and roots were markedly improved in response to the various fertilization treatments applied in this study with significant differences compared to control means in the two seasons. However, the superiority was for the individual treatment of amino acids (1g/l), which gave the highest records over the combined treatments in both seasons. This may be attributed to the role of amino acids in protein synthesis, its influence on IAA and GA bio-synthesis and its action as antioxidants prevent oxidation of the free radicals in plant cells (Smith, 1982; Walter and Nawacki, 1987; Khan *et al*., 2018). In this respect, El-Naggar *et al*., (2013) stated that spraying the foliage of *Lilium longiflorum* hybrids "Rubino and Red Alert" with amino acids solution (2ml/l) significantly increased plant height, leaf number, leaf fresh and dry weights, flowering duration, petiole length and bulb production. Likewise, Hashish *et al*., (2015) pointed out that foliar spraying with glutathione or thiamine (100 or 200 ppm for each) was very effective in improving growth and flowering characters of gladiolus plants under saline and non-saline conditions.

The second, third and fourth ranks after the previous superior treatment were occupied by T2, T4 and T3 combined treatments, respectively. This means that fortifying T1 (amino acids alone at 1 g/l) with either K_2SO_4 or Na_2SeO_4, or with both didn't cause any additional improvement in vegetative and root growth of treated plants although more scientists documented their benefits in enhancing growth of many crops, such as Aghighi *et al*., (2018) who declared that the foliar application of Se either alone or in combination with Fe could alleviate the adverse effects of NaCl stress on plant height, No. branches, leaf and biological yield and leaf mass ratio of *Stevia rebaudiana* plants. Similarly, JuanJuan and HaiJun (2018) concluded that low level of Se (1 ppm) can improve the tolerance of wine grape seedlings to copper stress, improve the activity of leaf antioxidant enzymes and decrease the degree of cellulose peroxidation level. Hence, it can mitigate the damage to grape seedlings by copper. On the other side, Euliss and Carmichael (2004) found that selenium at 2 ppm significantly reduced plant height, leaf number, flowering and seed set of canola (*Brassica napus*), seed viability and oil yield.

Regarding the benefits of potassium, Li *et al*., (2013) observed that leaf fresh weight and leaf area of *Datura arborea* increased by fertilizing with Jiabao (N: 12 %, K_2O: 44 %) and compound fertilizer of N:P:K = 2:1:1. Garaie *et al*., (2016) cited that K_2SO_4 increased No. lateral branche, leaf area, No. flowers, shoot fresh weight, flower longevity, membrane stability and seed germination of *Catharanthus roseus* plants. As the rate of K_2SO_4 increased from 5000 ppm to 15000 ppm, morphological characters were increased accordingly.

The aforestated findings are in great accordance with those suggested by El-Fawakhry and El-Tayeb (2003) on chrysanthemum, Abd El-Aziz *et al*., (2009) on *Antirrhinum majus*, Moustafa and Ebeid (2013) on *Albizzia lebbek* and *Taxodium distichum* and Khan *et al*., (2018) on two cultivars of bell pepper.

Table 1. Effect of fertilization treatments on some growth traits of *Eucalyptus citriodora* Hook plants during 2016/2017 and 2017/2018 seasons.

Treatments	Plant height (cm)		Stem diameter (cm)		No. leaves/plant		Root length (cm)	
	2016/2017	2017/2018	2016/2017	2017/2018	2016/2017	2017/2018	2016/2017	2017/2018
Control	30.47e	31.96e	0.25d	0.27d	17.66d	19.00d	30.27e	32.71e
T1	57.61a	58.21a	0.53a	0.56a	69.33a	74.52a	70.47a	75.60a
T2	52.83b	52.50b	0.48b	0.50b	23.68b	25.60b	43.33b	46.51b
T3	44.50d	47.33c	0.37c	0.39c	20.36c	22.07c	35.81d	38.67d
T4	47.63c	50.11bc	0.39c	0.42c	24.97b	27.01b	37.90c	40.95c

- T1: Amino acids mixture at 1 g/l, T2: T1 + K_2SO_4 at 2 g/plant, T3: T1 + Na_2SeO_4 at 1 g/l and T4: T1 + K_2SO_4 at 2 g/plant + Na_2SeO_4 at 1 g/l.

- Means within a column having the same letters are not significantly different according to Duncan's New Multiple Range t Test at P= 0.05.

Table 2. Effect of fertilization treatments on stem, leaves and roots fresh and dry weights of *Eucalyptus citriodora* Hook plants during 2016/2017 and 2017/2018 seasons.

Treatments	Fresh weight (g)						Dry weight (g)					
	Stem		Leaves		Roots		Stem		Leaves		Roots	
	2016/2017	2017/2018	2016/2017	2017/2018	2016/2017	2017/2018	2016/2017	2017/2018	2016/2017	2017/2018	2016/2017	2017/2018
Control	1.38e	1.49e	2.50d	2.69d	1.68e	1.78e	0.72d	0.78d	0.90d	0.96d	1.02d	1.11d
T1	4.60a	4.98a	7.35a	7.33a	7.10a	7.36a	2.10a	2.27a	2.86a	3.10a	3.11a	3.30a
T2	4.19b	4.50b	6.13b	5.98b	5.51b	5.73b	1.86a	1.99a	2.40b	2.53b	2.83b	3.03b
T3	2.16d	2.33d	2.68d	2.81d	2.67d	2.86d	1.13c	1.21c	1.07d	1.15d	1.18d	1.25d
T4	2.84c	3.08c	3.22c	3.46c	3.80c	4.01c	1.39b	1.50b	1.50c	1.61c	1.69c	1.84c

- T1: Amino acids mixture at 1 g/l, T2: T1 + K_2SO_4 at 2 g/plant, T3: T1 + Na_2SeO_4 at 1 g/l and T4: T1 + K_2SO_4 at 2 g/plant + Na_2SeO_4 at 1 g/l.

- Means within a column having the same letters are not significantly different according to Duncan's New Multiple Range t Test at P= 0.05.

2- Chemical composition:-

Data presented in Table (3) exhibit that all fertilization treatments used clearly increased chlorophyll a, b and carotenoids content (mg/g f.w.) as well as the percentages of both total soluble sugars and total carbohydrates in the leaves of fertilized plants. The prevalence was also for T1 (spraying with only amino acids mixture at 1 g/l), which was also followed by T2 (spraying with amino acids at 1 g/l + drenching with K_2SO_4 at 2 g/plant), except for carotenoids content which was raised to maximal value by T2 (0.320 mg/g f.w.) and followed by T4 (0.309 mg/g f.w.). Furthermore, total carbohydrates percentage was slightly decreased in the leaves of plants treated with T3 and T4 to 15.103 and 15.231 % against 15.897 % for control. In addition, the increment caused in the percent of total soluble sugars was, to some extent negligible. This may indicate the role of amino acids in promoting stroma lamella, grana and pigments biosynthesis. In this connection, El-Fawakhry and El-Tayeb (2003) clarified that a mixture of glutamic acid (1500 ppm) and cystine (500 ppm) scored the highest content of total chlorophyll in chrysanthemum leaves. El-Naggar *et al*., (2013) noticed that spraying the foliage of 2 cvs. of *Lilium longiflorum* with amino acid mixture at 2 ml/l rate caused significant increases in leaf chlorophyll a, b and total carbohydrates. Besides, Hashish *et al*., (2015) demonstrated that foliar spray with glutathione and thiamine (100 or 200 ppm for each) greatly increased pigment and total carbohydrates content and mineral ions percentage in gladiolus leaves.

On the other hand, the percent of N slightly decreased by T1 treatment, but increased to maximal mean (2.101 %) by T2 one. T3 and T4 treatments, however gave means equal to that of control to that of control (1.991 %). As for P and K percentages, they were pronouncedly increased by all fertilization treatments, but reached to the maximum by T4 treatment (spraying with amino acids and Na2Se|O4 at 1 g/l for each + drenching the soil mixture with K_2SO_4 at 2 g/plant), and followed by T3 treatment (spraying with amino acids and Na_2SeO_4 at 1 g/l for both). This may be attributed to lump the beneficial effects of the three compounds used in such work. In this regard, Moustafa and Ebeid (2013) implied that connecting between 3 antioxidants, namely ascorbic acid, citric acid and amino acid mixture (tryptophan + methionene + cysteine) each at 500 ppm greatly improved total carbohydrates, N, P, K and Mg in the leaves of *Albizzia lebbek* and *Taxodium disticum* seedlings. Abd El-All *et al*., (2013) found that combining between amino acids at 3 mg/l and Na_2SeO_4 at 3 g/kg soil significantly increased total chlorophyll, N, P and K % in the leaves of squash.

Such gains, however are coincide with those attained by Tawila (2018) on cock`s comb, HaiBin *et al*., (2018) on tea and Khan *et al.*, (2018) on bell pepper.

According to the previous results, it can be recommended to spray the foliage of *Eucalyptus citriodora* plants with the aqueous solution of amino acids mixture at 1 g/l, two times every month in winter (under cold conditions) to keep good growth and high quality plant.

Table 3. Effect of fertilization treatments on chemical composition of *Eucalyptus citriodora* Hook leaves during 2017/2018 season.

Treatments	Pigments (mg/g f.w.)			Total soluble sugars (%)	Total carbohydrates (%)	Macro-elements (%)		
	Chlo. A	Chlo. B	Carotenoids			N	P	K
Control	0.820	0.248	0.212	2.146	15.897	1.991	0.262	1.196
T1	0.962	0.589	0.294	2.143	23.211	1.663	0.319	1.310
T2	0.867	0.545	0.320	2.160	18.289	2.101	0.388	1.264
T3	0.863	0.344	0.290	2.151	15.103	1.991	0.395	1.380
T4	0.847	0.383	0.309	2.153	15.231	1.991	0.424	1.426

- T1: Amino acids mixture at 1 g/l, T2: T1 + K_2SO_4 at 2 g/plant, T3: T1 + Na_2SeO_4 at 1 g/l and T4: T1 + K_2SO_4 at 2 g/plant + Na_2SeO_4 at 1 g/l.

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دور الأحماض الأمينية، البوتاسيوم والسيلينيوم في تحسين نمو نباتات الكافور الليموني (*Eucalyptus citriodora* Hook) وزيادة تحملها للبرودة أو الصقيع

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أجريت هذه الدراسة في العراء بمشتل معهد بحوث البساتين، مركز البحوث الزراعية، الجيزة، مصر خلال فصل الشتاء لموسمي 2017/2016، 2018/2017 لمعرفة تأثير بعض معاملات التسميد، وهي: رش الأوراق بالمحلول المائي لمخلوط الأحماض الأمينية بمعدل 1 جم/لتر (T1)، المعاملة الأولى (T1) + تكبيش التربة بسماد سلفات البوتاسيوم بمعدل 2 جم/نبات (T2)، المعاملة الأولى (T1) + رش الأوراق بالمحلول المائي لسيلينات الصوديوم بمعدل 1 جم/لتر (T3)، المعاملة الثانية (T2) + رش الأوراق بمحلول سيلينات الصوديوم بمعدل 1 جم/لتر (T4)، بالإضافة إلى رش الأوراق بماء الصنبور فقط (كمقارنة)، وذلك على النمو والتركيب الكيماوي وتحمل شتلات عمر سنة للكافور الليموني (*Eucalyptus citriodora* Hook) النامية في أصص بلاستيك قطرها 25 سم ومملوءة بحوالي 4 كجم من مخلوط الرمل والطين بنسبة (1:1 بالحجم) لبرودة أشهر الشتاء. ولقد أضيفت المعاملات السابقة مرتين كل شهر في تجربة تامة العشوائية. أوضحت النتائج المتحصل عليها أن متوسطات جميع قياسات النمو الخضري والجذري (ارتفاع النبات، قطر الساق، عدد الأوراق/نبات، طول الجذر، والوزن الطازج والجاف للساق، الأوراق والجذور) قد زادت معنوياً نتيجة لإضافة جميع المعاملات سالفة الذكر مقارنة بمتوسطات الكنترول في كلا الموسمين. إلا أن السيادة كانت للمعاملة الفردية لمخلوط الأحماض الأمينية (المعاملة الأولي T1) والتي أعطت أعلى القيم مقارنة بالمعاملات المشتركة في كلا الموسمين. ولقد تم الحصول على اتجاه مشابه فيما يتعلق بمحتوى الأوراق من كلوروفيللي أ، ب، الكاروتينويدات، السكريات الكلية الذائبة والكربوهيدرات الكلية، حيث أحرزت المعاملة الأولى أيضاً (T1) أعلى المتوسطات لهذه المكونات مع بعض الاستثناءات القليلة. بينما كان العكس صحيحاً فيما يتعلق بتركيز الأوراق من النيتروجين، الفوسفور والبوتاسيوم %، حيث انخفضت النسبة المئوية للنيتروجين بدرجة طفيفة بالمعاملة الأولى (T1)، لكنها زادت إلى أقصى قيمة بالمعاملة الثانية (T2). وبالنسبة لتركيز الفوسفور والبوتاسيوم، فقد بلغت نسبتهما المئوية إلى أعلى قيمة بالمعاملة الرابعة (T4). وعليه، فإنه يكفي رش المجموع الورقي لنباتات الكافور الليموني عمر سنة والمنزرعة في أصص بلاستيك قطرها 25 سم بالمحلول المائي لمخلوط الأحماض الأمينية (بمعدل 1 جم/لتر)، مرتين كل شهر خلال أشهر الشتاء للحفاظ على نموها بشكل جيد ولجودة أفضل للنباتات.