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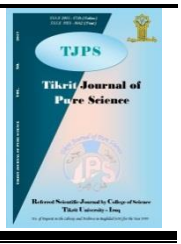

The Effect of Spraying a mixture of micronutrients and Plant Growth Regulators on A vegetative growth the Chemical Contents and some physical characters for volatile oils of Lemon grass Plant (*Cymbopogon citratus* L.)

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Abstract

A field experiment was conducted in the nursery of the Tikrit University/Faculty of Agriculture, the agricultural season 2013 on lemon grass plant. The Experiment was design with randomized complete block design (RCBD). the Experiment contained two factors, the first one is a mixture of some micro nutrients and three levels ; namely, non-spray treatment (T_0), spraying treatment with 50 mg.L^{-1} Fe + 25 mg.L^{-1} Cu +25 mg.L^{-1} Zn (T_1), and spraying treatment with 100 mg.L^{-1} Fe + 50 mg.L^{-1} Cu +50 mg.L^{-1} Zn (T_2). the second factor is plant Growth regulators with four levels first no plant Growth regulators labeled as (A_0), second, spraying in with IAA with concentration of 150 mg.L^{-1}. labeled as (A_1), spraying in with GA_3 with concentration of 150 mg.L^{-1}. labeled as (A_2) ,and spraying with mixture of IAA + GA_3 of 150 + 150 mg.L^{-1} concentration labeled as (A_3) with three replications. the result showed that the treatment of (T_2A_3) spraying with mixture of micro nutrients and spraying with mixture of Auxin and Gibberellin significant differences in all of the characteristics of the vegetative growth. this resulted the plant height 162.41cm, number of leaves 52.87 leaf.plant^{-1}, leaf area 3665.19 cm^2, dry weight 173.09 gm.plant^{-1}, and leaf content of total chlorophyll 8.350 mg.gm^{-1}.

There were also significant differences amongst the treatments of the interference in the increase of concentrations of the nutrients in the leaves. the treatments (T_2A_3), (T_2A_2),and (T_2A_1) exceeded the other treatments and the non-adding treatment while there were no significant differences amongst the above mentioned treatments in some of the concentrations of the nutrients. the interference treatment (T_2A_3) between the spraying with mixture of micro nutrients and spraying with mixture of (Auxin and Gibberellin) resulted the highest concentration of nitrogen, phosphorus, potassium, magnesium, Iron, Copper, and zinc. the concentration of these elements are 2.83 %, 0.390 %, 2.73 %, 0.892 mg.L^{-1}, 84.20 mg.L^{-1}, 17.73 mg.L^{-1}, 58.82 mg.L^{-1} respectively. There are positive differences in the content 0f the volatile oil of the active compounds amongst the interference treatments. the treatments (T_2A_3), (T_2A_2), (T_2A_1), and (T_1A_3) resulted the highest content of the active compounds compared to the rest of the treatments and the non-adding treatment. there were no significant differences amongst the above mentioned treatments. the interference treatment (T_2A_3) between the spraying with mixture of micro nutrients and spraying with a mixture of (Auxine and Gibberellin) resulted the highest rate of percentage, Density oil, Specific gravity, and Refractive index 0.834, 0.858, 0.845, 1.263 respectively.

Introduction

Now days, the medical plants taken an important role in the agricultural production and gains important at traction in many countries producing them. They are the main source of the medical plant drugs and are important source of the active material that enters in to preparing medicine in a form of extract ants and used as raw material in producing of some important chemical composites [1]. Lemon grass (*Cymbopogon citratus* L.) is one of the medical plant of the wide usage since a long time, it is a grass fragrant plant and Perennial macrobiotic of long soft leaves, similar to the leaves of Pampas grass, and grows in the hot countries such as Egypt, Sudan, Saudi Arabia, India, and east Africa [2]. Old and modern studies shows that this plant have many medical benefits for its high content of volatile oil which contains many composite (citral) which is of percentage is about % 65-90 (Granola) about % 1-4 ,and (mucine) about %10-25. This plant is used as disinfectant and southerner for headache and for curing rheumatism, it is also lowering the pressure and used for curing the ulcer and the inflammation of the colon in addition to the influenza and cold [3]., it is also dicing centuries for the growth of the micro organ sand fungi [4] .Industrially, it was used in saving foods and add in flavor to food [5].

The nutrient play vital role in growing and developing plants for its importance in the bio reactions, and have direct and indirect effects in the metabolism and activities of enzymes, proteins, oils, carbohydrates and vitamins [6]. The leaf fertilization is easy, quick, economic, and free from the soil problems especially the operation of stabilizing the elements in it. It is widely used recently, it gave good successful results especially with the micro elements that is added to the plant in small amounts. The spraying fertilization is more efficient and more economic [7]. Many studies conducted on using micro elements in the leaf spraying on the plants such as copper, iron, and zinc, for its importance to the plants, copper is one of the important elements that it has two main functions in the plants, first, it increases the oxidization efficiency for the Ascorbic acid enzyme, second, forming iron porphyrin which is the base of the chlorophyll color and its shortage appears on the newly grown plants that the apical bod and the leaves minimizes and be stiffened, the plant becomes diminished [8]. the iron is an important to the plant that it enters into the ferrodexine which important to the photosynthesis [9]. It is also in stabilizing the nitrogen actively and reduction of Nitrites in to among it also a auxiliary factor in forming chlorophyll and in forming the cytochrome which is important to the photosynthesis aspiration, the shortage of which causes the leaf veins yellowing [10]. zinc also triggers many of enzymes which contributes to the balance of the reaction which flowes in the green plastids, and plays vital role in the making of proteins and composition of the starch and helps in stabilizing the parts of the ribosome [11]. all of the growth of the plants are under the control of the plants 'hormones, that one plant hormone may regulate wide range of operation, in the other hand, one operation might be regulated through many plant hormones. commercially, the physiological effect for many plant hormones mere proved through the external use [12]. the highest impact of the plant hormone happens in a limited in the lifecycle of the cell. It is formed in active sites in the plant called Meristem [13], Auxine are materials or growth regulators characterized with its ability to trigger or elongating and cell division and high abacas when used in suitable concentrations and works in the phase of embryo formation and triggering of orientation [14]. Gibberellins are activating and hormones, and are Terpenoides composites consist of four isoprene units naturally made in the plant [15] .

More than 136 types of gibberellins whether derivated from plant or fungi [16]. Growth regulator, gibrilic acid is one of the composites of gibberellin group that is predicted in the developed plants and smokiness of fungi, and charactized with basic serial composition called "Gibban skeleton" which consist of 19-20 carbon atom linked with four or five rings and varies in containing either carboxyl COOH or Aldehyde CHO [17]. This study aims to know the effect of spraying with mixiture of micro nutrients Zn, Fe, Cu and sparing with growth regulators (IAA, GA_3) on the characteristic of the vegetative growth and chemical content and some of the physical of the volatile oil for the lemon grass .

Materials and Methods

Afield experiment conducted in the plant nursery in Tikrit University / College of Agriculture in the season of 2013 on the lemon grass (*Cymbopogon citratus* L.). The plants were planted as similar seedling in pots of 30 cm diameter and 30 cm height . It was filled with the mixture and peat moss with 1: 2 portion and of three pots for each treatment. The experiment implemented acceding to the RCBD with three replications, each replication contains 12 experimental units, the suitable treatments were divided to the investigated factors, It is a mixture of the micro nutrients with three levels and the growth regulators with four levels, and as follows.

The first factor :- mixture of micro nutrients.

1- Non-spraying of any element and this treatment symbolized with (T0).

2- Spraying with (50 $mlg.lit^{-1}$ Fe + 25 $mlg.lit^{-1}$ Cu + 25 $mlg.lit^{-1}$ Zn) experimental . $unit^{-1}$. And symbolized as (T1).

3- Spraying with (100 $mlg.lit^{-1}$ Fe +50 $mlg.lit^{-1}$ Cu +50 $mlg.lit^{-1}$Zn) experimental. $unit^{-1}$. And symbolized with (T2).

The second factor:- Growth regulators

1- Non-adding growth regulators and symbolized with (A0) .

2- Spraying with (IAA) with concentration of (150 $mlg.lit^{-1}$) and symbolized with (A1).

3- Spraying with (GA3) with concentration of (150 $mlg.lit^{-1}$) and symbolized with (A2).
4- Spraying with mixture of (IAA+GA3) with concentration of (150 +150 $mlg.lit^{-1}$) and symbolized with (A3) .
Thus, the number of treatments are (12) randomly planted in each replication which are the suitable treatment for interference of the two factors levels. The mixture T1and T2 were sprayed with two batches, the first, when forming the seventh leaf, the second is after (45) days of the first batch , the growth regulators were sprayed with two batches (10) days for each batch after spraying the micro nutrients mixture and the following characteristics were studied, plant height (cm), Number of leaves (leaf. $plant^{-1}$) and leaf area (cm^2. $plant^{-1}$) then the leaf area of the leaves were got and were measured according to the following equation:
leaf area = max length * max width * 0.75[18] .
The dry weight (gm) for the vegetative group by drying the vegetative group in a shadowed place in the open around the average of the experimental unit and the sensitive balance until the stabilizing of the weight, the total estimation of chlorophyll ($mlg.gm^{-1}$ fresh weight). Samples of the leaves of the lemon grass were taken, 0.5 gm of the fresh weight for these leaves and put in dark- colored cans and (20 ml) of Aston were added 80 % and left in dark for (24 hours) and was repeated until the full extraction of chlorophyll . The final size of the extract ant solution reached $50ml.gm^{-1}$, and the chlorophyll was estimated by using the method of [19], using the spectrophotometer .
The nitrogen concentration were estimated (N%) using micro kildyle according to the method of [20], the phosphorus (P%) by the color method using the spectrophotometer and according to the method of [21], potassium (k%) were estimated using flame photometer. Mg, Fe, Cu, and Zn were using the atomic absorption spectrophotometer (6200 AAbrand) in the labs of the chemical engineering / college of engineering / Tikrit university.
Some physical characteristics of the volatile oil of the lemon grass by extracting the volatile oil using the steam distillation described in British Herb pharmacopoeia using the Clevenger linked to volumetric iround 2 Liter and the leaves were cut after being dried and cleaned, and 100 gm of which were put in the volumetric iround. and 200 ml of the normal water added and the distillation were done mantle and took about 3-4 hours for each sample and varied according to the used treatments, the distilled oil were separated using separator funnel, and 100 ml of the distilled water and 40 ml of di ethyl ether in two stages and the mixture were shaken and left to be stable to separate in to two layers, the higher is the ether with the oil and the second is the layer of the water , the higher layer that contains the volatile oil and the lower layer is re-extracted (the aqua extract ant) as second stage teen sure the full extraction of oil from the sample. The samples were gathered and were added 2-3 gm of the non-aquatic $mgso_4$ for drying and absorbing the water drops found in the higher layers of the, than the ether is steamed using rotary vacuum evaporator (R.E). under the unstable pressure cite 25-30 $^{\circ}$. The percentage, the qualitative weight, oil density, and refractive index of the volatile oil were measured. Estimation of the physical characteristics of the volatile oil of for the lemon grass .
The physical characteristics of the volatile oil for lemon grass were estimated depending on the methods of [22], and as follows :
1- The percentage of the oil .
The percentage of the oil is estimate from the result of the division of the weight of the extracted oil on the weight of the plant sample used for the extraction of (100 gm) of the dry leaves for each treatment multiplied by 100 .
2- Qualitative weight
It was estimated by taking 100 micro liter of the oil in an accurate weight capillary then the weight of that size were estimated using sensitive balance of four decimal greedy and in 20 $^{\circ}$ by dividing the weight of that size of oil on the weight of the same size of the distilled water in the same temperature .
3- Density of oil.
It was estimated as mlg / micro liter by taking 100 micro liter of oil in 20 $^{\circ}$ divided by its size and on the same temperature .
4- Refractive Index .
It represents the ratio between the sin- of the angle of the incidences of the light and the angle of refraction in specific temperature [23].
The refractive factor for all of the volatile oil samples were estimated using Abbe refrectometer (Abbe Tube Universal) brand from Schmlett and Haensch (21201) German Companions at (20)$^{\circ}$. The results of the research were stoically analyzed according to RCBD in the factorial experiment and the averages of the effects of the factors of the study and their interference were compared using Duncin Test of multi borders [24], and were and analyzed using the statistical program (mini tab) using computer .

Results and Discussion

Table (1) shows the effect of spraying a mixture of micro nutrients and some plant growth regulators and its interference in the vegetative growth characteristics for lemon grass, it shows that spraying a mixture of micro nutrients of 100 $mlg.lit^{-1}$ Fe + 50 $mlg.lit^{-1}$ Cu + 50 $mlg.lit^{-1}$ Zn concentration .It resulted significant increase in all of the characteristics of the vegetative growth compared to the other treatments and the treatment of non-spraying, while the sprning with growth regulators super seeds significant at all the characteristics of the vegetative growth, the treatment of spraying a mixture of (IAA, GA3) gave the highst significant differences compared to the other treatments and the treatments of non-spraying. the table shows that the interference between the

mixture of micro nutrients and the vegetative growth regulators shows significant effect that all the treatments of the interference were characterized with significant increases treatments (T_2A_3), (T_2A_2), and (T_2A_1), super seeds in all of the characteristics of the vegetative growth on all of treatments and the treatments and the treatment of non-adding ,while there are no significant differences between all of the aforementioned treatments ,the interference treatment was characterized (T_2A_3) between the spraying with micro nutrients with concentration 100 mlg.lit^{-1} Fe +50 mlg.lit^{-1} Cu +50 mlg.lit^{-1} Zn and spraying with mixture of (oxine and gibberellin) with concentration of (150 mlg.lit^{-1}) gave the highest significant differences in the hight of the plant which are (162.41) cm, and number of leaves (52.87) leaf. Plant^{-1}, and the leaf area of the plant (3665.19) cm^2.plant^{-1}, and a dry weight of the vegetative group which is (173.09) gm.plant^{-1}, and leaves content of the total chlorophyll (8.350) mlg.gm^{-1}. the comparison treatment gave the lowest average of the aforementivred characteristics which is (124.05 cm, 25.28 leaf. Plant^{-1}, 1174.00 cm^2. plant^{-1}, 97.03 gm.plant^{-1}, and 6.130 mlg. gm^{-1}) respectively . The increase of growth characteristics may be due to the role of the micro nutrients in many functions and activities within the plant, Zinc has its importance in activating many enzymes such as Enolase and peptidase and important in forming the amino acid, the Treptophane which is a basic material in making the (IAA) hormone which is in important hormone for growing the stem and embranchment and elongation, thus increasing the vegetative growth. Fe also enters into the formation of phlopho protein which is important in the bio oxidation, and the plants need it in the cell division, and enters into the formation of the some colorings [7], It also enters in forming the cytochromes which is important in the processes of photosynthesis and respiration, Fe has an important role in forming proteins for its participating in activated many enzymes especially that are the responsibly of forming proteins and in forming of chlorophyll for the capability of the iron ions on gaining and losing the electrons which helps in activation of the enzymes which enter in to the oxidation reduction side the plant tissue which happens during the respiration and photosynthesis and the enters in the composition of porphyrin and cytochrome. iron concentrates in high ratio in the green plastids in the plants and this expresses the high importance of iron in the process of photosynthesis [25].

Table (1) The effect of spraying with micro nutrients and plant growth regulators and interferences on the characteristics of the vegetative growth in Lemon Grass

Total chlorophyll mlg . gm^{-1}	The dry weight vegetative group gm . Plant^{-1}	Leaf Area Cm^2 . Plant^{-1}	No .leaves Leave. Plant^{-1}	Plant height Plant^{-1}. Cm	Characteristics / Treatments
6.66 c	117.03 c	1610.25 c	31.26 c	131.98 c	T_0
7.157 b	142.45 b	2449.00 b	145.09 b	145.09 b	T_1
8.266 a	161.33 a	3231.80 a	48.01 a	155.57 a	T_2
7.032 c	115.27 d	3391.77 c	30.81 c	131.33 c	A_0
7.472 b	145.88 b	2602.59 b	41.85 b	148.83 b	A_1
7.355 b	144.56 c	2566.78 b	40.54 b	146.25 b	A_2
7.586 a	155.38 a	2951.00 a	44.39 a	150.44 a	A_3
6.130 f	97.03 f	1174.00 f	25.28 f	124.05 g	T_0A_0
6.864 de	119.17 e	1605.29 e	33.17 d	134.71 e	T_0A_1
6.615 e	118.23 e	1583.41 e	32.49 d	134.00 e	T_0A_2
7.035 cd	133.72 d	2078.32 d	34.11 d	135.19 e	T_0A_3
6.835 de	118.15 e	1512.11 e	29.00 e	129.87 f	T_1A_0
7.210 bc	147.31 c	2600.79 c	41.05 c	151.37 b	T_1A_1
7.210 bc	145.01 c	2573.63 c	39.43 c	145.40 c	T_1A_2
7.375 b	159.33 b	3109.50 b	46.21 b	153.74 b	T_1A_3
8.131 a	130.63 d	2117.00 d	38.15 c	140.07 d	T_2A_0
8.343 a	171.17 a	3601.71 a	51.33 a	160.43 a	T_2A_1
8.240 a	170.45 a	3543.30 a	49.70 a	159.37 a	T_2A_2
8.350 a	173.09 a	3665.19 a	52.87 a	162.41 a	T_2A_3

the figures that have the same letters under them means that they have no significant differences according to minty borders Duncin Test at probity level of 5% .

The effect of copper in increasing the vegetative growth is due its positive action in the photosynthesis because it enters in forming chloroplast proteins and is part of the cycle of electron travelling which links the two systems of the photoreaction of the photosynthesis and using the materials made in the photosynthesis in the increasing the vegetative growth [26].

The results is conforming with what [27], reached on the increase of the characteristics of the vegetative growth and the dry weight of the leaves when spraying garlic (*Allium Sativum* L.), with iron and Zinc. The increase of the characteristics of the vegetative growth may be due to that the treatment with the plant growth regulators develops most of the plant parts [28] .

This Wight be due to the role of Auxine in activating the gen replication then the interpretation and activating the production of RNA and protein [29]. Spraying IAA leads to the development of the roots which positively reflects on the absorption of water and nutrients, thus increasing the characteristics of the vegetative growth [30]. the increase of the characteristics of the vegetative growth might also be due to the role of GA3 that encourages the growth and increase the cell divisions and increasing of the cell width which leads to more vegetative growth [31].

The treatment with Gibberellin encouraged the work of the internal Gibberellins and that led to the increase proem ability of the membranes and made it a strong at traction center for nutrients, and elongation [32]. which positively reflected in increasing the vegetation growth .

Table (2) Shows the effect of spraying with micro nutrients and plant growth regulators and its interference in the chemical content of the lemon grass. It shows that spraying with mixture of nutrients caused positive significant differences for all the concentration nutrient elements in the leaves compared to non- spraying, especially the treatment T_2 100 mlg.lit^{-1} Fe +50 mlg.lit^{-1} Cu +50 mlg.lit^{-1} Zn it significantly supersede by increasing the concentration of all of the nutrients elements to the other treatment and the treatment of non- spraying. We notice that the spraying treatment with the growth regulators made significant differences to all of the treatments, the treatment of spraying with mixture of (Auxine and gibberellin) characterized with the highest concentration of Nitrogen in the leaves which was (2.22%) compared with the other treatments and the comparison treatment compared to the other treatments and the comparison treatment which is (1.39%). The table shows that there are significant differences between the interference treatments, the treatments (T_2A_3), (T_2A_2), and (T_2A_1), in increasing all of the concentration of the nutrients and the nutrients elements to the other treatments and the treatments of non- spraying, while there were no significant differences between all of the aforementioned treatments in some concentration of the nutrient elements. The interference treatment (T_2A_3) between spraying of mixture of micro nutrients with concentration 100 mlg.lit^{-1} Fe + 50 mlg.lit^{-1} Cu + 50 mlg.lit^{-1} Zn and spraying with mixture of (Auxine and gibberellin) with concentration (150 +150 mlg.lit^{-1}) in giving the highest concentration for the Nitrogen in the leaves which amounted (2.83 %). The treatment of comparison gave the lowest average for the Nitrogen in the leaves amounted (1.07%).Table (2) shows the effect of spraying with mixture of micro nutrients and plant growth regulators and its interference in the concentration of the phosphorus. It is seen that the treatment of spraying with mixture of micro nutrients caused significant increase in the concentration of phosphorus in the leaves compared to the treatment of comparison.

It is noticed that the treatment of spraying the plant with mixture of (Auxine and gibberellin) significantly superseded the treatment of using (Auxine and gibberellin) solely. The same table shows that there are significant differences between the treatment of interference, the treatments (T_2A_3), (T_2A_1), and (T_1A_3), Supersedes in the increasing of the concentration of phosphorus on the other treatments and the treatment of non- spraying, while there were no significant cant differences between all of the Aforementioned treatments .

The interference treatment (T_2A_3) characterized between the spraying with mixture of micro nutrients with phosphorus 100 mlg.lit^{-1} Fe + 50 mlg.lit^{-1} Cu + 50 mlg.lit^{-1} Zn and spraying with mixture of (Auxine and gibberellin) with concentration of (150 + 150 mlg.lit^{-1}) in giving the highest concentration of phosphorus in the leaves which amounted (0.390%), while the comparison treatment gave the lowest average of phosphorus concentration of phosphorus in the leaves which amounted (0.309%) It also that there are significant effects for the studied factors in the concentration of potassium and Magnesium, in the lemon grass leaves. The treatment of spraying with mixture of micro nutrients caused significant increase in the leaves content of potassium and Magnesium compared to the comparison treatment. the treatment of spraying the plant with mixture of (Auxine and gibberellin) significantly Supersedes the treatments of using Auxine and gibberellin Solely and the comparison treatment.

The interference between the spraying with mixture of micro nutrients and plant growth regulators showed significant effects that all of the interference treatment characterized with significant increases in the concentration of potassium and Magnesium compared to the other treatments and the treatment of comparison, the interference treatment (T_2A_3) between the spraying with mixture of micro nutrients with concentration 100 mlg.lit^{-1} Fe + 50 mlg.lit^{-1} Cu + 50 mlg.lit^{-1} Zn and spraying with (Auxine and gibberellin) with concentration (150 + 150 mlg.lit^{-1}) characterized with giving the highest concentration for potassium and Magnesium in the leaves which Amounted (2.37%, 0.892%) respectively, while the treatment of comparison gave the lowest average for the concentrations of potassium and Magnesium in the leaves which Amounted (1.9%, 0.420%) respectively, It is also clear that spraying with mixture of micro nutrients caused significant increases in the concentration of iron and cupper in the leaves compared to non - adding. The table shows that spraying with growth regulators caused significant increase in the concentrations of iron and cupper for all of the treatment compared to the treatment of non-adding, It also shows that the interference spraying with mixture of micro nutrients and growth regulators caused significant to the treatment of the comparison .

Table (2) The effect of spraying with micro nutrients and plant growth regulators and interferences in the chemical content of the Lemon Grass .

Conc Zn mlg.lit^{-1}	Conc Cu mlg.lit^{-1}	Conc Fe mlg.lit^{-1}	Conc Mg%	Conc K%	Conc P %	Conc N %	characteristics / Treatments
26.56 c	6.78 c	58.94 c	0.458 c	1.72 c	0.327 c	1.34 c	T_0
34.09 b	12.72 b	67.79 b	0.604 b	2.30 b	0.360 b	1.89 b	T_1
53.51 a	16.76 a	81.55 a	0.693 a	2.47 a	0.374 a	2.54 a	T_2
32.66 d	10.16 c	65.78 c	0.480 d	1.80 c	0.332 c	1.39 c	A_0
40.23 b	12.66 b	69.92 b	0.595 b	2.21 b	0.358 b	2.08 b	A_1
36.93 c	12.17 b	72.55 a	0.554 c	2.18 b	0.351 b	2.02 b	A_2
42.39 a	13.37 a	72.46 a	0.710 a	2.45 a	0.374 a	2.22 a	A_3
23.02 h	5.09 f	52.35 f	0.420 h	1.19 f	0.309 g	1.07 g	T_0A_0
28.00 g	7.31 e	60.18 e	0.484 f	1.80 e	0.328 f	1.32 e	T_0A_1
27.17 g	7.11 e	60.09 e	0.445 g	1.75 e	0.323 f	1.37 e	T_0A_2
28.05 g	7.63 e	63.15 d	0.486 f	2.14 d	0.351 d	1.63 d	T_0A_3
29.88 eg	10.31 d	66.50 d	0.505 ef	2.10 k	0.340 e	1.26 f	T_1A_0
35.07 e	13.43 bc	67.41 cd	0.580 d	2.32 c	0.360 c	2.17 b	T_1A_1
31.10 f	12.31 c	76.23 b	0.578 d	2.29 c	0.358 c	1.93 c	T_1A_2
40.31 d	14.85 b	70.05 c	0.754 b	2.49 b	0.383 a	2.20 b	T_1A_3
45.09 c	15.09 b	78.50 b	0.517 ef	2.12 d	0.349 d	1.85 c	T_2A_0
57.63 a	17.25 a	82.17 a	0.723 b	2.53 b	0.386 a	2.75 a	T_2A_1
52.53 b	17.10 a	81.35 a	0.641 c	2.50 b	0.372 b	2.76 a	T_2A_2
58.82 a	17.63 a	84.20 a	0.892 a	2.73 a	0.390 a	2.83 a	T_2A_3

the figures that have the same letters under them means that they have no significant differences according to minty borders Duncin Test at probity level of 5% .

The treatment (T_2A_3), (T_2A_2), and (T_2A_1), Supersedes in the increasing of the concentration of iron and cupper to the other treatments and the treatment of non- adding while there were no significant differences between the Aforementioned treatments. The treatment of interference (T_2A_3) between the spraying with mixture of micro nutrients with concentrations 100 mlg.lit^{-1} Fe + 50 mlg.lit^{-1} Cu +50 mlg.lit^{-1} Zn and spraying with mixture of (Auxine and gibberellin) with concentration of (150 + 150 mlg.lit^{-1}), gave the highest concentrations for iron and cupper in the leaves which amounted (84.20 mlg.lit^{-1}, 17.63 mlg.lit^{-1}) respectively, While the treatment comparison gave the lowest average for the concentrations of iron and cupper in the leaves which amounted (52.35 mlg.lit^{-1}, 5.09 mlg.lit^{-1}) respectively.

Table (2) shows that spraying with micro nutrients led to a positive significant increase in the concentrations of Zinc compared to the treatment of comparison. spraying with growth regulators caused significant increase in the concentration of Zinc and that the treatment of spraying with mixture of (Auxine and gibberellin) gave the highest concentrations Zinc which amounted (42.39 mlg.lit^{-1}) compared to the other treatment and the treatment of comparison the table shows that there are significant differences between the interference treatment which are spraying with micro nutrients and growth regulators compared to non-adding. The treatment (T_2A_3) characterized with the increase of Zinc the other treatments and the non-adding treatment. There were no significant differences between the Aforementioned. The treatment of interference (T_2A_3) between the spraying with mixture of micro nutrients with concentrations 100 mlg.lit^{-1} Fe +50 mlg.lit^{-1} Cu + 50 mlg.lit^{-1} Zn and spraying with mixture of (Auxine and gibberellin)

with concentration (150 +150 mlg.lit^{-1}) characterized with giving the highest concentration for Zinc the leaves which Amounted (58.82 mlg.lit^{-1}) while the treatment of comparison gave the lowest average for the concentrations of Zinc in the leaves which Amounted (23.02 mlg.lit^{-1}). The increase in the concentration of the nutrients I the leaves of the lemon grass may be due to the role of the micro nutrients in many physiological activities in the plant. The Zinc important to build proteins in activating enzymes of phosphate transportation by the Co-enzymes NAD and NADP, and this may be due to the positive relationship between the Zinc concentration in the leaves and the activity of Ribonucleic enzyme which is important for producing RNA so, regulating the Protein making [33]. cupper is an important element in representing the carbohydrates which triggers the absorption of NH_3^+ ions as a result of triggering the metabolism of amino by providing the carbonic skeleton and it is one of the motive elements inside the tissues of the plant and the transportation is organic united with the amino acids forming negative ionic compounds which is believed that they are the compounds that transport cupper inside the plant [34]. in addition , cupper is an important element in the electronic transportation Series which links the two systems of the chemical Photosynthesis in the process of Photosynthesis and thus may help absorb the enzymes elements and because the potassium works as auxiliary factor in wide number of enzymes that's why, this process need the absorption of potassium and its concentration increase [35].

iron has important role informing the protein for its participation in Activity of many enzymes especially those response for building Protein and chlorophyll for the capability of the iron ions to attract and lose electrons which helps the activity of enzymes which enters into the oxidization and reduction inside the plant tissues which occurs during the Photosynthesis and respiration that it enters into the formation of Porophyrin and cytochrome. iron highly concentrate in the green plastids in the plant and reaches 90% of its weight and this indicates the high importance of iron in the process of Photosynthesis [25].

The increase may be due to the concentrations of the nutrients to the important role of Auxine which is the increase of the vegetative growth by the increase of cell divisions and widening of cells and finally giving the biggest leaf area [36]. This will lead to the increase of the vital activity of the plant such as the Photosynthesis and the need of plant to plenty of important nutrients which has active role in the physiological process and will lead the plant to absorbing it from the soil to get the nutrition balance inside plant [37]. spraying Auxine increase its level in the plant which increase the concentrations of green colors[38], as it is one of the hormones of youngness which lessens the hormones of aging which causes the degradation of chlorophyll [39]. which increases the age of the plant which reflects on the absorption of the nutrients . or may due to the activation of gibberellin for the cell division and elongation and thus triggering the formation of the new RNA and increasing the vital process inside the plant cells such as the travelling to the vegetation group [40]. This will positively reflects on the increase of concentration of the nutrients I the plant .

Table (3) shows that there are positive significant differences in some physical character is tics of the volatile oil between the interference treatments which are spraying with micro nutrients and growth regulators compared to the treatment of non-adding, The treatments (T_2A_3), and (T_1A_3), gave the highest percentage of volatile oil compared to the other treatments and the treatment of non-adding, which there are were no significant differences between the aforementioned treatments. The treatment of interference (T_2A_3) between spraying with mixture of micro nutrients with concentration 100 mlg.lit^{-1} Fe + 50 mlg.lit^{-1} Cu + 50 mlg.lit^{-1} Zn and spraying with mixture of (Auxine and gibberellin) with concentration (150 +150 mlg.lit^{-1}) gave the highest percentage of volatile oil which amounted (0.834 %) compared to the treatment comparison which gave the lowest percentage (0.371%). The table shows that there are significant differences in the density of the volatile oil between the interference treatments, the treatments (T_2A_3), (T_2A_2), (T_2A_1), and (T_1A_3), gave the highest density for the volatile oil compared to the other treatments and the treatment of non- adding, while there were no significant differences between aforementioned treatments. The treatments of interference (T_2A_3) between spraying with mixture of micro nutrients with concentration (100 mlg.lit^{-1} Fe +50 mlg.lit^{-1} Cu +50 mlg.lit^{-1} Zn) and spraying with mixture of (Auxine and gibberellin) with concentration of (150 +150 mlg.lit^{-1}) gave the highest density of oil which amounted (0.858) compared to the treatment comparison which gave the lowest value (0.763). The table shows that there are positive significant differences in the increase of the qualitative weight for the volatile oil between which are the spraying with the micro nutrients and the growth regulators compared to the treatment of the non-adding. The interference treatment (T_2A_3) between spraying with mixture of micro nutrients with concentration (100 mlg.lit^{-1} Fe +50 mlg.lit^{-1} Cu +50mlg.lit^{-1} Zn) and spraying with mixture of (Auxine and gibberellin) with concentration of (150 +150 mlg.lit^{-1}), gave the highest qualitative weight (0.845), compared to the treatment comparison which gave the lowest qualitative weight which amounted (0.661). The table also shows that there are significant positive differences in the increase of the concentration of the refractive factor between the treatments of the interference, the treatments (T_2A_3), (T_2A_2), (T_2A_1), (T_1A_0), and (T_1A_3), gave the highest refractive factor compared to the other treatments and the treatment of non- adding, while there were no significant differences between the aforementioned treatments.

The interference treatments of (T_2A_3), (T_2A_1), and (T_1A_3), gave the highest refractive factor which amounted (1.263), compared to the treatment comparison which gave the lowest refractive factor which amounted (1.234).

Table (3) The effect of spraying with micro nutrients and plant growth regulators and interferences in some physical characteristics of the volatile oil of the Lemon Grass

Refractive factor	Qualitative weight of the Volatile oil	Density of the Volatile oil	Percentage of Volatile oil	Characteristics Treatments
1.241 c	0.688 c	0.785 c	0.447 c	T_0
1.252 b	0.773 b	0.832 b	0.634 b	T_1
1.262 a	0.806 a	0.843 a	0.736 a	T_2
1.245 c	0.707 c	0.796 c	0.474 c	A_0
1.252 b	0.763 b	0.824 b	0.602 b	A_1
1.250 b	0.753 b	0.821 b	0.612 b	A_2
1.259 a	0.799 a	0.840 a	0.735 a	A_3
1.234 d	0.661 i	0.763 e	0.371 g	T_0A_0
1.240 c	0.683 h	0.788 d	0.433 f	T_0A_1
1.239 c	0.680 h	0.784 d	0.428 f	T_0A_2
1.252 b	0.729 f	0.807 c	0.557 d	T_0A_3
1.241 c	0.711 g	0.811 c	0.481 e	T_1A_0
1.253 b	0.781 d	0.832 b	0.623 c	T_1A_1
1.251 b	0.778 d	0.830 b	0.617 c	T_1A_2
1.263 a	0.824 b	0.855 a	0.815 a	T_1A_3
1.262 a	0.751 e	0.841 b	0.572 d	T_2A_0
1.263 a	0.827 b	0.853 a	0.750 b	T_2A_1
1.262 a	0.803 c	0.850 a	0.791 b	T_2A_2
1.263 a	0.845 a	0.858 a	0.834 a	T_2A_3

the figures that have the same letters under them means that they have no significant differences according to minty borders Duncin Test at probity level of 5% .

The effect of the growth regulator in the increase of the percentage of the volatile oil in the leaves may be due to that the treatment of Auxine and gibberellin caused the increase in the vegetative growth, number of leaves, width, and thickness of leaves, and increase in the absorption of the nutrients elements which leads to the increase of building or activation of some enzymes (enzymes of the metabolic pathway) which are responsible of the increase in the production of the Subsidiary compounds .Which positively reflects on increasing the percentage of the volatile oil [41]. The micro elements is not less important, than the macro elements in its effects on the volatile oil processes pathway and on the increase of the active compounds which reflects on the increase of the oil density and the percentage [42]. The increase of percentage of the volatile oil may be due to the growth regulators in activating the growth and metabolism of the terponoids which results changes of benefits on the quantity and quality of the terponoids [43]. This may also be due to the action of Auxine and gibberellin and micro elements in increasing the Photosynthesis and subs equality the increase of the secondary metabolism results. The results are con formed with what [44] , the increase of selery plant of the active material when Fertilizing it with micro elements, and conforms with the results of [45], in increasing the leaf content of the active material for three types of

the mentha when Fertilizing it with iron and Zinc. It also conforms with the results of [46] , when treating some medical Extractor plant such as agafa and Opuntia ficus with Auxine acid and gibberellin, led to the increase of its content of active materials. The effect of spraying with growth regulators and micro nutrients may be due to the increase of the formation of solid compounds (Oxygenic compounds) , and its heaping in the volatile oil which reflects on giving high value of the qualitative weight and the density of the volatile oil [47]. Which results from the increase of the volatile oil density which leads to the increase of the refractive factor [48].

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تأثير الرش بخليط من العناصر الغذائية الصغرى ومنظمات النمو النباتية في صفات النمو الخضري والمحتوى الكيميائي وبعض الصفات الفيزيائية للزيوت الطيارة لنبات حشيشة الليمون (*Cymbopogon citratus* L.)

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الملخص

اجريت تجربة حقلية في المشتل التابع الى كلية الزراعة / جامعة تكريت، في الموسم الزراعي 2013 على نبات حشيشة الليمون. نفذت كتجربة عاملية وفق تصميم القطاعات العشوائية الكاملة RCBD تضمنت التجربة عاملين العامل الاول خليط من بعض العناصر الغذائية الصغرى وبثلاثة مستويات وهي معامله عدم الرش ويرمز لها T_0 والرش ب 50 ملغم. لتر$^{-1}$ Fe + 25 ملغم. لتر$^{-1}$ Cu + 25 ملغم. لتر$^{-1}$ Zn ويرمز لها T_1 والرش ب 100 ملغم. لتر$^{-1}$ Fe + 50 ملغم. لتر$^{-1}$ Cu + 50 ملغم. لتر$^{-1}$ Zn ويرمز لها T_2 . العامل الثاني منظمات النمو النباتيه باربعة مستويات عدم الرش بمنظمات النمو ويرمز لها A_0 والرش بـ IAA بتركيز 150 ملغم. لتر$^{-1}$ ويرمز لها A_1 والرش بـ GA_3 بتركيز 150 ملغم. لتر$^{-1}$ ويرمز لها A_2 والرش بخليط من GA_3 + IAA بتركيز 150 + 150 ملغم. لتر$^{-1}$ ويرمز لها A_3 وبثلاث مكررات. وقد بينت النتائج ان معامله T_2A_3 الرش بخليط من العناصر الغذائية الصغرى والرش بخليط من الاوكسين والجبرلين اعطت فروقات معنوية في كافه صفات النمو الخضري فكان اعلى ارتفاع للنبات بلغ 162.41 سم. وعدد الاوراق 52.87 ورقة. نبات$^{-1}$ والمساحة الورقية للنبات 3665.19 سم^2 والوزن الجاف للمجموع الخضري بلغ 173.09 غم. نبات$^{-1}$ ومحتوى الاوراق من الكلوروفيل الكلي8.350 ملغم .غم$^{-1}$. بينما كانت هناك فروقات معنوية مابين معاملات التداخل في زيادة تراكيز العناصر الغذائية في الاوراق اذ تفوقت كل من المعاملة T_2A_3 و T_2A_2 و T_2A_1 على بقية المعاملات ومعاملة عدم الاضافة، في حين انة لم تكن هناك فروقات معنوية بين كل من المعاملات المذكورة اعلاة في بعض تراكيز العناصر الغذائية وتميزت معاملة التداخل T_2A_3 بين الرش بخليط من العناصر الغذائية الصغرى والرش بخليط من (الاوكسين والجبرلين) بأعطاء اعلى تركيز للنتروجين والفسفور والبوتاسيوم والمغنسيوم والحديد والنحاس والزنك. اذ بلغت تراكيز هذه العناصر 2.83 % و 0.390 % و 2.73% و 0.892 ملغم. لتر$^{-1}$ و84.20 ملغم. لتر$^{-1}$ و 17.73 ملغم. لتر$^{-1}$ و58.82 ملغم. لتر$^{-1}$ على التوالي. وهنالك فروقات معنوية موجبة في بعض الصفات الفيزيائية للزيت الطيار مابين معاملات التداخل, وقد تميزت المعاملات T_2A_3 و T_2A_2 و T_2A_1 و T_1A_3 في اعطائها اعلى فروقات معنوية موجبة في معظم الصفات الفيزيائية للزيت الطيار مقارنة ببقية المعاملات ومعاملة عدم الاضافة. في حين انة لم تكن هناك فروقات معنوية بين كل من المعاملات المذكورة اعلاة. وتميزت معاملة التداخل T_2A_3 بين الرش بخليط من العناصر الغذائية الصغرى والرش بالخليط من الاوكسين والجبرلين بأعطاء اعلى فروقات في كل من النسبة المئوية وكثافة الزيت والوزن النوعي ومعامل الانكسار بلغت0.834 , 0.858 , 0.845 , 1.263 على التوالي.

الكلمات المفتاحية: حشيشة الليمون، النحاس، الحديد، منظم النمو.