ORIGINAL ARTICLE

Qualitative Response to the Content of Lemongrass Leaves From Medicinally Effective Compounds Due to the Influence of Environmentally Friendly Factors

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ABSTRACT

Introduction: A research experiment was carried out in a private nursery in Baghdad to study the effect of different fertilizer treatments (biological and organic) on the effective medicinal compounds of lemongrass (Cymbopogon citrates) - (Poaceae family), volatile oil yield and its physical characteristics. **Methods:** The treatments included Azotobacter, Trichoderma, Tri. + Azo. , Compost, Azo. + Comp, Tri. + Comp) in addition to the control treatment. A complete randomized design (C.R.D) with four replications was used. **Results:** The results showed a significant difference in the effective medicinal compounds by the treatment of (Tri. + Comp), which achieved significant superiority in Myrcene (414.8 ppm), while the treatment (Azo. + Comp) achieved significant superiority in Citral (164.7ppm), Limonene (162ppm) and Neral (112.3ppm), but there were no significant difference in Nerol and Cotrenellol. **Conclusion:** The control treatment achieved the lowest results for all the studied characteristics. The present study showed that the fertilizer treatments effected the volatile oil yield and the refractive index of lemongrass plants, and the combination treatment (Tri+ comp.) was exceeded and gave the highest average for both volatile oil characteristics.

Keywords: Azotobacter, Trichoderma, Compost, Volatile oil

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INTRODUCTION

The medicinal plants interesting has increased in most countries of the world during recent times, as it plays a large and important role in human life due to the breadth of its uses and its large types number. The commercial demand for medicinal plants has increased in various parts of the world with the increase in scientific research as an alternative to manufactured medicines for the many side effects of chemical drugs and the greater risks to the consumer. Medicinal plants are the main source for the production of plant medicinal drugs and a source of active substances used in the preparation of many pharmaceutical preparations (Arnavut, 2015).(1) Lemongrass (*Cymbopogon citrates L.*) - (Poaceae family), which belongs to the Poaceae family, is one of the plants with wide medicinal use since ancient times. The ancient and modern studies have shown that this plant has several medicinal benefits due to its high content of oil that contains the main compound Citral (65-90%), as well as Myrcene (10-25%). It's original home in India, and it is a tetra-carbon plant whose cultivation has spread in all hot, semi-hot and temperate regions. It can be cultivated throughout the year except for November and December. It is preferred to plant it in February as the growth is rapid (Al-Mayah, 2001 and Al-Sayed, 2009).(2-5)

The development of methods helps effectively in increasing the production of secondary metabolites that represent the active substance with a physiological effect to suit the wide demand for it due to the expelled population increase. Decomposing organic fertilizers and bio-fertilizers provide the necessary nutrients needed by the plant as well as its physical and chemical changes in the soil, contribute to improving the soil texture and fertility (Muslat and Musleh, 2015 and Abu Saud et al., 2017) (5). This study aims to improve the growth and production of lemongrass plants (C*ymbopogon citrates)* - (Poaceae family) from medically active substances and their oil content due to its high medical and pharmacological effect and to use its medicinal extract to curb harmful bacterial activity to humans and reduce the risk of cancer (6-8).

MATERIALS AND METHODS

A factorial experiment was carried out in a nursery in Baghdad during 2019 from 3/10/2019 to 7/20/2020 to study the effect of various biological and organic fertilizer treatments on effective medicinal compounds and the use of leaf extract in curbing harmful bacteria and stopping the spread of cancer cells in the human body (9,10). The seeds were sown in plastic pots (30 cm in diameter) with one plant per pot. Complete randomized design with four replications was used, each replication contented 4 pots. The results were analyzed according to the GenStat 2008 program, and using the lowest significant difference and at a 5% probability level to compare the means (Al-Asadi, 2019). Seven different treatments were used in the experiment, (Control, Azotobacter, Trichoderma, Tri. + Azo., Compost, Azo. + Comp. and Tri. + Comp).

The biological vaccines (Azotobacter bacteria and Trichoderma fungi) were added to the potting soil at a depth of 10 cm and left for 3 days, and then irrigated daily for homogenizing and multiplying the bacterial and fungal inoculum in the potting soil. Organic fertilizer (decomposed plant waste), was added by mixing with the potting soil at a rate of (3: 1), then the seeds were planted. After the end of the experiment, the effective compounds, oil characteristics and yield were evaluated.

An estimate of the active compounds in the volatile oil of the lemongrass plant (*Cymbopogon citrates*) - (Poaceae family)
The active compounds in the volatile oil extracted from the leaves were evaluated and identified in the laboratories of the Ministry of Science and Technology - Department of Environment and Water with Gas Chromatography Technology (GC-2010), the type of Shizadzn of Japanese origin, which used an ionized flame detector (FID) and used a capillary separation column (SE-30) with lengths (0.25 mm x 30 m) under the conditions shown in Table (1). This method is described as one of the modern and effective methods for its high efficiency, infinite accuracy and high speed, so it was applied to separate the components of volatile oils and obtain a quantitative and qualitative estimate of them at the same time (11,12).

The separation process is carried out by first injecting the used solvent, then it is injected again to clean the separation column and get rid of the remaining material if it is found. Then the sample is injected and then the solvent is injected again, so the solvent is injected between each sample injection and the other and the cleaning process is done and the remaining materials are disposed of inside the separation column. The Standard material was separated inside the separation column and is translated in the form of a drawing (Peaks), as it has a specific retention time, on which the samples match after their separation and union with the device. After the samples were injected, they just could volatilize, i.e. turn into a gaseous state (Mauricio et al., 2007) (13,14). The concentrations of the active ingredients were measured on the column according to the following model concentration equation:

$$\frac{\textit{diluting factor compound concentration (ppm)}}{\textit{sample weight}} = \frac{\textit{solution concentration} \times \textit{sample area}}{\textit{standard solution area}}$$

Table (I) : Conditions for separating the active compounds by the GC device.

Paragraph name	Conditions
The temperature of the injection area	280 ° C
Detector temperature	320 ° C
The temperature range of the column	150 - 300 ° C (15 ° C
separator	sec.$^{-1}$
Gas pressure	100 KPa

RESULT

First: Medically effective compounds (ppm)
Figure 1 shows that the treatment (Tri + Comp.) significantly superior compared to most of the treatments used in this experiment, as it achieved the highest rate of Myrcene in volatile oil (414.8 ppm), followed by the treatment (Azot. + Comp.), which gave a rate of 399.5 ppm, while the lowest rate for this compound was achieved from the control treatment (268.1 ppm).

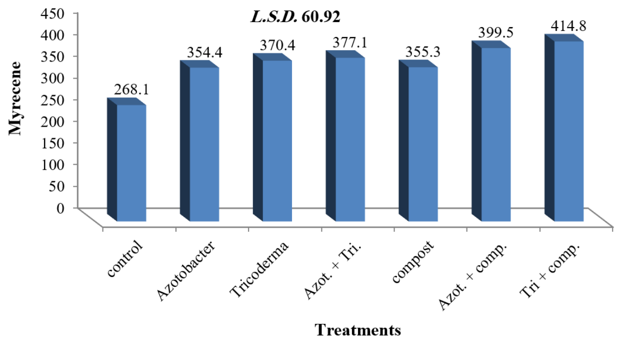

Figure 1: ???

For the two compounds Nerol and Cotrenellol in volatile oil, it appears from Figures 2 and 3 that there are arithmetic differences between the transactions without raising the level of significance. The combination (Tri + Comp.) and (Azot. + Comp.) achieved the highest rate of (120.8 and 118) ppm, respectively, for the Nerol compound and (245.3 and 253.1) ppm respectively for the Cotrenellol compound, while the control treatment gave the lowest rate of (83.3 and 211.1) ppm for the two compounds respectively.

The same thing was repeated for Citral compound in volatile oil, as the treatments did not differ significantly.

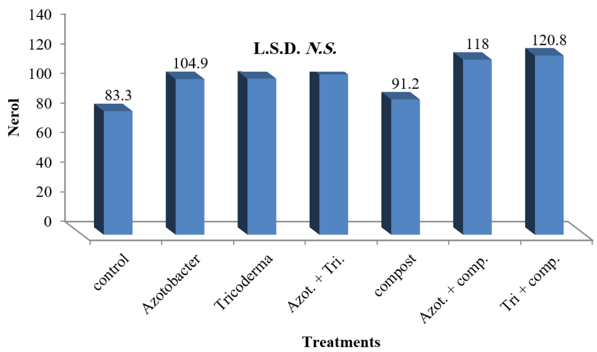

Figure 2:?????

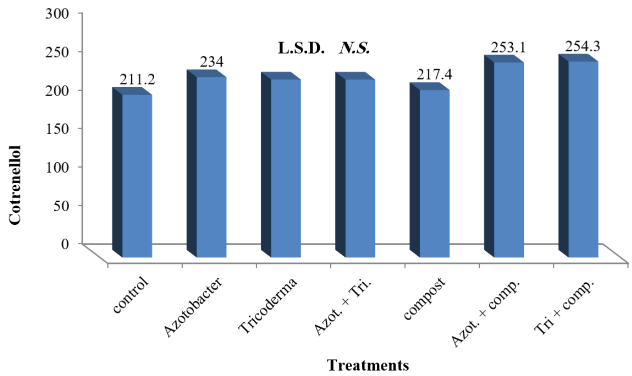

Figure 3:?????

The combination (Azot. + Comp.) achieved the highest rate of 164.7 ppm against 117.1 ppm from the control treatment that recorded the lowest rate for this compound as shows in Figure 4.

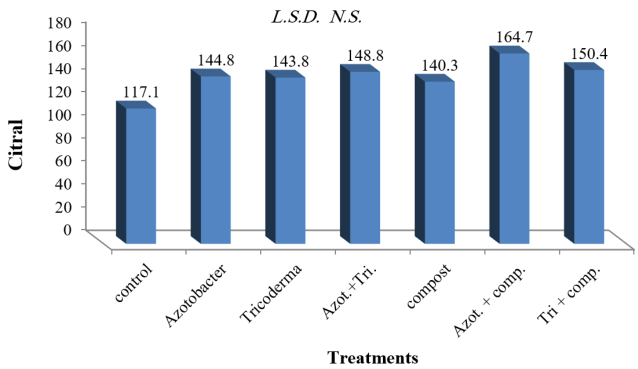

Figure 4:?????

The treatment of plants with different fertilizers resulted in a significant increase of Limonene and Neral compounds in volatile oil, as shown in Figures (5 and 6). As the combination treatment (Azot. + Comp.) gave a significant superiority over the two treatments of control and compost only without significant differences with other treatments. It gave the highest rate of 162ppm compared with the control treatment which recorded an average of 123.1ppm of Limonene. Whereas, it gave 112.3 ppm of Neral compound, which was superior compared to control and (Trichoderma), while the lowest rate for this compound was achieved in the control treatment (65.8ppm).

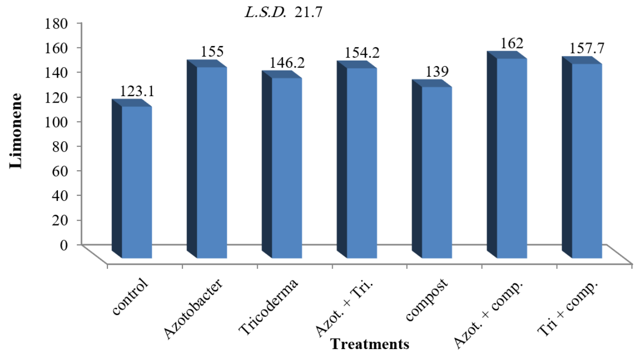

Figure 5:?????

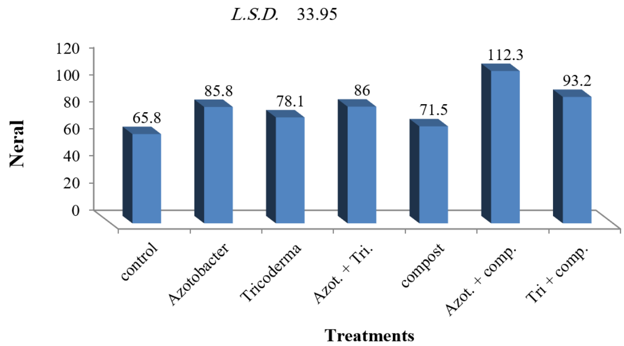

Figure 6:?????

DISCUSSION

The significant effect of biological fertilizer (Azotobacter bacteria and Trichoderma) interaction with the compost, may be attributed to the characteristics that both factors possess in bringing about many positive changes that occur in the medium of plant growth, as the plant's activities are affected. The physiological and metabolic activity of the nitrogen-fixing bacteria, whose effect is reflected in the plant growth. Whereas, the role of biological fertilization with bacteria and fungi come in the same direction in producing a significant increase in the indicators of effective medicinal compounds and the yield and physical characteristics of volatile oil. The positive effect of biological fertilization is due to the increase in the efficiency of nutrient absorption and the improvement of root growth indicators that worked to increase the area of absorption by the capillaries. This was reflected in the increase in the effective compounds, oil indicators (Kadhim, et al., 2020). Also, the increase in the processed materials in the leaves represented by proteins and carbohydrates as a result of the effectiveness of microorganisms added to the growth medium was reflected in the building of plant tissues, which consequently resulted in the improvement of the level of vegetative and specific growth by providing balanced nutrients that improve plant growth (Abdel-Hamid et al., 2014 and Kadhim & Almyali, 2020). Also, the improvement of the studied indicators brought about by compost in interaction with microorganisms may be due to its important role in the formation of organic acids upon its decomposition (such as humic acid, folic acid and natural chelates) that contribute to a high degree in the liberation of minerals necessary for growth and the increase in the formation of organic acids formed by the dissolved compost (Salman & Abdel Wahab, 2016 and Asree et al., 2019). Compost also contributes to increasing the activity and effectiveness of micro-microorganisms by increasing their numbers and the resulting increase in growth regulators that are produced by them, including auxin, which promotes the absorption of nutrient mineral elements (Salman et al., 2008 and AlMyali et al., 2019). Using compost with biological fertilizer stimulates the activity of microorganisms and supplies them with sufficient nitrogen for their growth in addition to its contribution to increasing the effectiveness of important enzymes needed by the plant in its vital activities, including phosphatase, thus increasing the mineralization and readiness of organic phosphorous (Khan et al., 2007 and Kadhim et al., 2021).

CONCLUSION

The present study showed that the fertilizer treatments effected the volatile oil yield and the refractive index of lemongrass plants (Cymbopogon citrates) - (Poaceae family), and the combination treatment (Tri+ comp.) was exceeded and gave the highest average for both volatile oil characteristics.

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(please insert your acknowledgement)

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