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Impact of Vermicompost on Lemon Grass (*Cymbopogan Flexuosus L*) Production and Oil Contents.

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ABSTRACT

This research paperwas intended to examine the influences of vermicompost on growth, yield and oil in lemongrass. The research was carried out in medicinal plant farming areas in VayalpadMandal, Chittoor district, Andhra Pradesh, India, to evaluate the essential components like height of the lemongrass plant, tillers per plant accumulation of aromatic oil and biomass production. The plants were treated at 2, 4, 6, 8 and 10 g per plant and compared with respective control plants. The application of vermicompost at 10 g per plant influenced significantly and produced maximum height 86,Number of tillers per lemongrass plant were seen at (107) and herb production (317 g/plants). The results of the study once again revealed that the application of vermicompost has a positive influence on selected attributes by significant increase in oil contents at 10 g treated plants.

Keywords: Vermicompost**,** *CymbopoganFlexuosus* L., Citral, Biomass and Oil content

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INTRODUCTION

Cymbopoganflexuosus belongs to Poaceae family, which grow at tropical environment and a tall sedge plant. Lemongrassnative aromatic plants grows even in sub-tropical areas in Africa and south East Asia. In India, it is cultivated inMaharashtra, Karnataka, Andhra Pradesh and Tamil Nadu[1]. In the study area from 2014 farmers were took initiation and started to cultivate the lemongrass plants due to its commercial value of lemongrass oil and citral. Secondly due its capability to grow at tropical conditions. As a whole, India lemongrass plantation was introduced way back a century ago. At present it is commercially cultivating at study area, which ismostly indigenous to South East Asia, Australia and South Asian territories.Throughout the India lemon grass which is cultivating namely C. flexuosus, also known as Cochin grass which is an indigenous native plant to India, Thailand, Burma and Sri Lanka and the other popularly cultivated lemon grass is Cymbopogan citratus, these two species are today cultivated throughout tropical Asia [1].

At present, in India this crop is cultivated in approximately 3,000 ha area. Across the globe, lemongrass is cultivated and flourished in wide variety of soils like rich loam to poor laterite and waterlogged soils are not suitable to cultivate lemongrass[1, 2]. India is one of the largest producers amongst Asian countries and to market the lemongrass oil in India there are two markets available Mumbai and Cochin [1]. About eighty percent of the Indian lemongrass cultivators are exportingin the form of lemongrass oil across the globe namely United States of America, Thailand, Europe and United Kingdom. The lemongrass oil consists high percentage of variety of terpenes namely myrecene and limonene. Apart from the terpenes nerol, linolool, heptenone and geroniol pertains in the lemongrass essential oil even after extraction citral, this shows evidently, these kind of minor fractions needs high purity to pippin the good returns and largely has to be produced [1].

Furthermore, the lemongrass oil citral will be processed into citronellal, geranyl acid and nitrite, geraniol.The chemical composition of essential oil widely varies and depends on habitat, diversity in genetics of the lemongrass plant and agro economic sustainability. Due to citral in lemongrass leaves it exhibits lemony favour. Citral used in production ionone and beta-carotene[3]. Procedures to isolate lemon grass oil with high citral, are highly sensitive, sophisticated methods, and even which are under the patent rights. This is one of the drawback of these kind of procedures to produce citronellal. To avoid such strong constraints farmers must therefore much need to be made attempts to develop according to their capabilities to produce highly purified farms of citronellal[1, 2].

Especially in India lemongrass is popularly used to isolate the citral, which is used in manufacturing of vitamin-A. In manufacturing of ionone's citral is the start-up material as well as in cosmetics, perfumes and flowers as natural fragrances. A trace levels of lemongrass oil used in detergents, soaps and other home cleaners and used as fuel for the distillation of lemongrass at the unit [1, 3]. Lemongrass spent is a fertilizer source, applied after composting or ash to fertilize the lands, mulching of coffee, checking soil erosions and can be prepare paper [4].

The lemongrass essential oil popularly used in aromatherapy which is isolated from the C. Ctratus. Now a days Lemongrass isone of the finest replacement for lemon due its lemony, sweet smell and long-lasting natural fragrance. Despite of that lemongrass is not acidic like lemon and rich source for vitamin-A [1, 3]. These meritorious qualities has given edge to lemongrass oil rather than lemony flavour. The aromatic essential oil constitutes approximately 80% of citral and soluble in alcohol [5, 6]. Sugandhi (OD-19) was the most widely used variety in the study area due its adaptability to a wide variety of soils and climatic conditions [7]. The main objective of the investigation was to evaluate the effect of vermicompost at different doses to boost up the growth, biomass of the lemongrass plant and essential oil content in lemon grass variety OD-19 [1]. In the study vermicompost applied to the lemongrass plants through foliar application

Natural essential oils are plant extracts of different parts of the plants. Out global number of plants 10 percent contains these essential oils or as sources [8, 9]. Essential oils are of diverged and complexed volatile in nature with predominantly terpenes which will again closely compactly associated ketones, aldehydes and alcohol and typically extracted from fresh or partially dried leaves [8, 9]. The active substance of medicinal plants are used mainly in cosmetics, food, natural flavouring agents, pharmaceuticals and perfumes. China and India play a major role in production of essential oils followed by Sri Lanka, Indonesia, and Vietnam1.

Lemongrass varieties contains 1-2 percentage of essential oil on dry basis [3, 10]. Number of attempts have been made to prove anti-oxidative and antifungal properties of lemongrass oil[3, 10, 11].

Moreover, some times the content and percentage of citral may influenced by wide range of factors namely light intensity, climate, temperature, moisture content of soil, maturity and most importantly fertilizer [9, 12]. Enormous number of research have been made and furnished that overall essential oil production is associated with early growth stage in lemongrass plants namely so called Cymbopogon flexuosus [13], Cymbopogon martini [14] and Mentha [15]. Commonly, production of lemongrass oil is highly correlates with the biomass yield. Production of oil with high citral contents determined by the proportion of youngleaves to older and method of extraction [9, 15-19]. Gas chromatography-mass spectrometry (GC-MS) has been the most applied analytical techniques for essential oil analysis [9, 20, 21].

Since the yield of essential oil and citral content are of very much important due to their commercial value.Hence, it is essential to identify the proper harvesting method and time of harvesting is very much necessary for farmers to obtain high quality citral content in essential lemongrass oil with less production cost [22, 24, 25]. The objective of this study was to determine the vermicompost influences on chemical composition of lemongrass oil, maturity of leaves, essential oil content, and citral content of lemongrass.

MATERIALS AND METHODS

Experiment was conducted during the March 2015 to January 2016 at VayalpadMandal, Reddy Vari Palli, Chittoor District, Andhra Pradesh, India. This research aimed to elevate the Vermicompost (Prepared by the farmers by using cow dung, plant wastages and lemongrass spent)influences on growth yield, oil content of lemon grass. The experiment was conducted in randomized design of four replication blocks. Slips of lemongrass were collected uniformly from the farmers and seedlings planted at 1x1 m, depth about 15-17 cm. same was cultivated at time intervals of 3 daysfor the first one month, later on 7,8,9 and 10 days subsequently.Vermicompost was applied at 2, 4, 6, 8 and 10 g/plant applied weekly once after plantation slips seedling. Compost was applied for three replicates and other one remains as control. It is an entirely randomized design.

The main parameters were number of leaves per plant, growth of the plant as height, number tillers, biomass yield selected in this study. The same attributes were measured and recorded accordingly. Leaf area of lemongrass was measured by laser area meter CI-203 [23]. Height of the randomly selected lemon grass plants were recorded and tabulated for analysis. Fresh weight of the fresh plants was measured by using electronic balance. Finally most important attribute in view of the farmers economic benefits the natural essential oil of lemongrass leaves were extracted by Clevenger apparatus, which is used to isolate lemongrass oil in small quantities [24, 25].

Statistical Analysis of the Data:

The data were presented as mean ± SEM. Statistical analysis was performed using analysis of variance (ANOVA) followed by Dunnett's test, using SPSS 10.0 version.

RESULTS AND DISCUSSION

The results of the present study shows a significant yield and growth of the lemongrass plants, it reveals that the application of compost through the soil per individual plant rather than the application to entire soil. It is Obvious that the nutrients of applied compost were directly absorbed by the experimental lemongrass plant.

The results of the present study Shows that the significant growth in all selected doses of plant height (cm) at 2g 67.501 ± 0.536, 70.112 ± 0.85, 4 g 78.87 ± 1.031, 83.349 ± 0.963 and 86.446 ± 3.061 respectively at 4, 6, 8 and 10 g respectively when compared with their respective control Lemon grass plants(58.428 ± 0.783 at $p < 0.001$). Plant spread (cm)85.59 ± 0.832, 87.345 ± 0.851, 89.645 ± 0.579, 91.131 ± 0.509, 94.27 ± 1.027, respectively at2, 4, 6, 8 and 10 g respectively when compared with their respective control Lemon grass plants (61.853 ± 1.557, at $p < 0.001$). Number of tillers 79.382 ± 0.511, 83.782 ± 0.978, 90.768 ± 1.098, 100.185 ± 1.162 and 107.642 ± 0.983 respectively at2, 4, 6, 8 and 10 g respectively when compared with their respective

control Lemon grass plants (50.443 ± 0.584, at p <0.001). Leaf area $cm^2$32.271 ± 1.217, 34.451 ± 0.828, 62.683 ± 1.214, 91.738 ± 0.716 and 148.553 ± 0.974 respectively at 2, 4, 6, 8 and 10 g respectively when compared with their respective control Lemon grass plants (21.692 ± 0.373, at p <0.001). Herb yield g/plant62.73 ± 0.519, 64.468 ± 0.933, 177.672 ± 1.103, 225.194 ± 2.019 and 317.49 ± 6.769 respectively at 2, 4, 6, 8 and 10 g respectively when compared with their respective control Lemon grass plants (61.211 ± 0.872, at p <0.001 and 0.004). Oil content %0.402 ± 0.006, 0.419 ± 0.008, 0.669 ± 0.0348, 0.976 ± 0.00874 and 1.317 ± 0.17 respectively at 2, 4, 6, 8 and 10 g respectively when compared with their respective control Lemon grass plants (0.362 ± 0.0138 at p <0.001).

In all concentrates of the compost applications found that significant increase in the oil and citral concentrates it reveals that the in addition to above aforementioned fertilizer schedule [25]. A significant overall enhanced growth difference of selected attributes were observed in all applications namely production rate of biomass, components of yield. The accumulation of lemongrass oil in leaves were shown a significant improvement (Table.1, 2, 3, 4, and 5).

The results of the present study reveals that the all applications are showing a highly significant variants when compared with their respective control lemongrass plants (table.1). As mentioned, a significant maximum growthof the experimental plan shows at 10 g is 86 cm, where as in 2 g treated plant was observed as 67 cm. The significant difference in lemongrass spread was observed at 94 and whereas 85 at 2g dosage level par each other.

The results of the present study shows a significant variations as follows maximum at 106 and herbage at 350 g/ plant, hence provided the solid concrete proof towards the number of tillers per lemongrass plant at the study area when compared with their respective controls. The results of the present study clearly indicated that in all concentrates of compost stem, colour and rib remains same. It indicates that there is no decreasing trends in attributes like essential oil, leaf area, which will influences the oil production and yield of the oil. So this gives a solid evidence to the farming community it very much beneficial to apply the compost or any other naturally prepared organic compost to reduce their production cost and increase in profitability.Once again it is evidenced that the maximum leaf growth was observed 148, 91, 62, 34, and 32 cm at dose levels of 10, 8, 6, 4 and 2g respectively.

In view of the farmer's profitability, one of the most important attribute is lemongrass oil content in the leaf the present study once again revealed that thepercentage of oil increased in all the dosages of compost applications.In contrast with results of minimum oil with chemical fertilizers [26-28].

In Andhra Pradesh, especially at study are most of the farmers expressed their views on farmer waivers on crop loans are very poor in ground level, Bankers are considering the most of farmers under defaulters, so they will not get loans in future, apart from this there is no provision in crop insurance facilities with special reference to natural and aromatic crops, high cost of fertilizers and plant material, lacking of skilled labor, lack of awareness on government schemes and about incentives, lacking of credit loans from the banks, they don't have enough idea about fluctuations in price and marketing system The most of respondents expressed their concern about drought and scarcity of water during peak season of production and another most important constraint disseminated by the farmers is electricity problems.

The farmers are also concerned about persistent increase in pesticides and fertilizer prices. Based on the identified constraints it is recommended that government should ensure water supply and electricity through-out the year, especially in the summer. Secondly, need to take initiative steps to provide more loan facilities through the NABARD. Thirdly Awareness campaign among farmers should be initiated by government of Andhra Pradesh to cultivate the best practices of Lemon grass production. Results of the present study has suggested that the diligence should be paid to address and overcome the above said constraints. So that the aromatic cultivators and other farming growers would be able to get a higher price for their agricultural products. Needy support should be initiated on good practices for lemongrass cultivation and in this direction research institutions should play a major leading role.Eventually, the study has revealed that the stakeholders should take some immense endeavors to strengthen the agricultural practices, understand the market information system and to inculcate positive signs on lemongrass cultivation and it these steps will lead to other farmers willing to cultivate commercial plants.

Obligatory correlative research studies on lemongrass oil with high percentage of citralcontent and chemical composition of oil, more biomass generation and which variety is giving more commercially more production would helpfarming community.

From the results of the present study it is concluded that at the highest concentration of compost will enhance the attributes namely, height of the plant, tiller number per the lemongrass plant and most importantly on herbage yield due its commercial value were observed and maximised accumulations of lemongrass oil and lemony flavour due its increased citral concentrates in leaves in all experimental plants. Hence it is suggestable that natural fertilizer should be used at all seasons, irrespective of chemical fertilizer and farmers need to reduce the chemical fertilizers as much as they can to get more profits due to minimized production costs and to protect the environment as well.

Table 1: Effect of compost at the dosage level of 2 g on selected attributes namely growth parameters, content of oil, leaf size, yield, biomass, and number of tillers.

Attribute	Control	Experimental	Mean SD	Anova
Plant height (cm)	58.428 ± 0.783	67.501 ± 0.536	0.572	p <0.001
Plant spread (cm)	61.853 ± 1.557	85.59 ± 0.832	0.78	p <0.001
Number of tillers	50.443 ± 0.584	79.382 ± 0.511	0.343	p <0.001
Leaf area cm^2	21.692 ± 0.373	32.271 ± 1.217	0.563	p <0.001
Herb yield g/plant	61.211 ± 0.872	62.73 ± 0.519	0.449	p <0.004
Oil content %	0.362 ± 0.0138	0.402 ± 0.00666	0.0068	p <0.001

Table 2: Effect of compost at the dosage level of 4 g on selected attributes namely growth parameters, content of oil, leaf size, yield, biomass, and number of tillers.

Attribute	Control	Experimental	Mean SD	Anova
Plant height (cm)	58.428 ± 0.783	70.112 ± 0.85	0.149	p <0.001
Plant spread (cm)	61.853 ± 1.557	87.345 ± 0.851	0.784	p <0.001
Number of tillers	50.443 ± 0.584	83.782 ± 0.978	0.504	p <0.001
Leaf area cm^2	21.692 ± 0.373	34.451 ± 0.828	0.401	p <0.001
Herb yield g/plant	61.211 ± 0.872	64.468 ± 0.933	0.564	p <0.001
Oil content %	0.362 ± 0.0138	0.419 ± 0.00896	0.007	p <0.001

Table 3: Effect of compost at the dosage level of 6 g on selected attributes namely growth parameters, content of oil, leaf size, yield, biomass, and number of tillers.

Attribute	Control	Experimental	Mean SD	Anova
Plant height (cm)	58.428 ± 0.783	78.87 ± 1.031	0.511	p <0.001
Plant spread (cm)	61.853 ± 1.557	89.645 ± 0.579	0.734	p <0.001
Number of tillers	50.443 ± 0.584	90.768 ± 1.098	1.535	p <0.001
Leaf area cm^2	21.692 ± 0.373	62.683 ± 1.214	1.697	p <0.001
Herb yield g/plant	61.211 ± 0.872	177.672 ± 1.103	1.541	p <0.001
Oil content %	0.362 ± 0.0138	0.669 ± 0.0348	0.048	p <0.001

Table 4: Effect of compost at the dosage level of 8 g on selected attributes namely growth parameters, content of oil, leaf size, yield, biomass, and number of tillers.

Attribute	Control	Experimental	Mean SD	Anova
Plant height (cm)	58.428 ± 0.783	83.349 ± 0.963	0.549	p <0.001
Plant spread (cm)	61.853 ± 1.557	91.131 ± 0.509	0.712	p <0.001
Number of tillers	50.443 ± 0.584	100.185 ± 1.162	1.620	p <0.001
Leaf area cm^2	21.692 ± 0.373	91.738 ± 0.716	1.01	p <0.001
Herb yield g/plant	61.211 ± 0.872	225.194 ± 2.019	2.823	p <0.001
Oil content %	0.362 ± 0.0138	0.976 ± 0.00874	0.012	p <0.001

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Table 5: Effect of compost at the dosage level of 10 g on selected attributes namely growth parameters, content of oil, leaf size, yield, biomass, and number of tillers.

Attribute	Control	Experimental	Mean SD	Anova
Plant height (cm)	58.428 ± 0.783	86.446 ± 3.061	1.397	p <0.001
Plant spread (cm)	61.853 ± 1.557	94.27 ± 1.027	1.435	p <0.001
Number of tillers	50.443 ± 0.584	107.642 ± 0.983	1.347	p <0.001
Leaf area cm^2	21.692 ± 0.373	148.553 ± 0.974	1.362	p <0.001
Herb yield g/plant	61.211 ± 0.872	317.49 ± 6.769	1.968	p <0.001
Oil content %	0.362 ± 0.0138	1.317 ± 0.17	0.237	p <0.001

Figure 1: Effect of compost at different levels of dosage on selected attribute growth parameters, content of oil, leaf size, yield, biomass, and number of tillers.

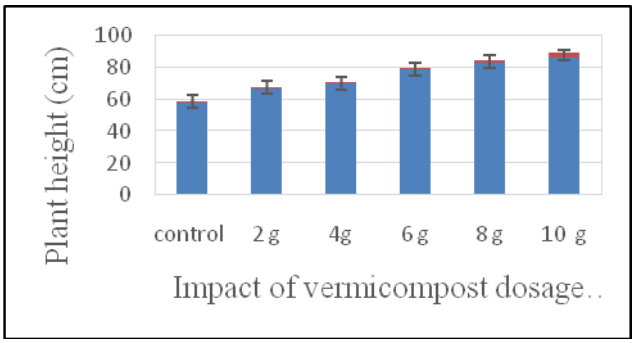

Figure 2: Effect of compost at different levels of dosage on lemongrassplant spread

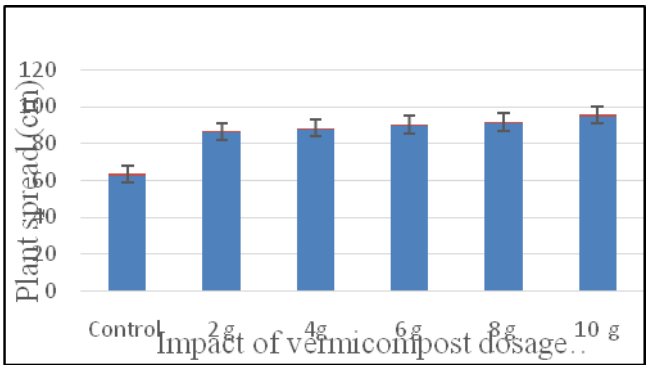

Figure 3: Effect of compost at different levels of dosage on umber of tillers in lemon grass.

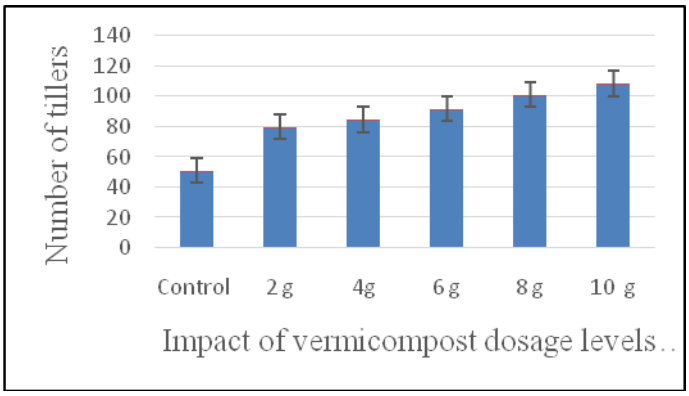

Figure 4: Effect of compost at different levels of dosage on lemongrass leaf size.

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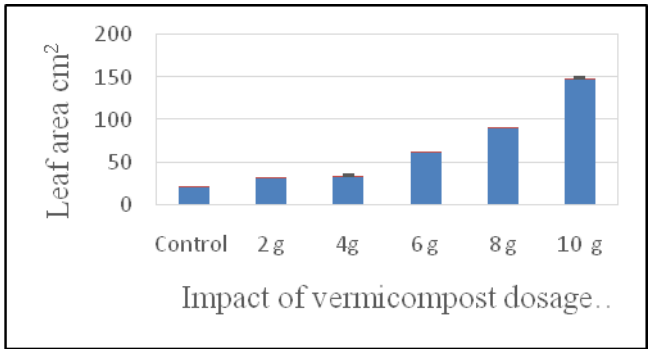


Figure 5: Effect of compost at different levels of dosage on selected attribute herb yield of lemon grass at study area.

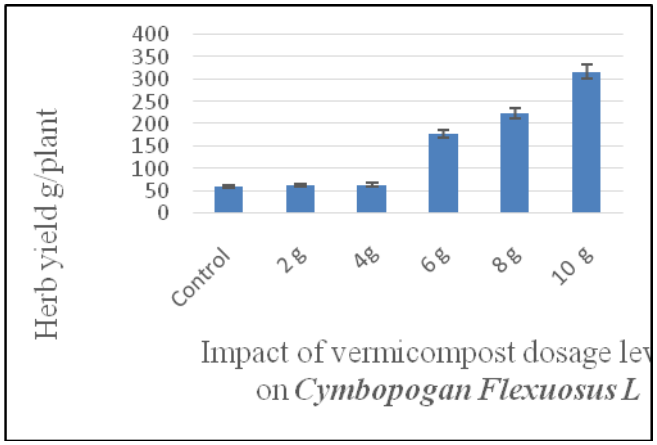
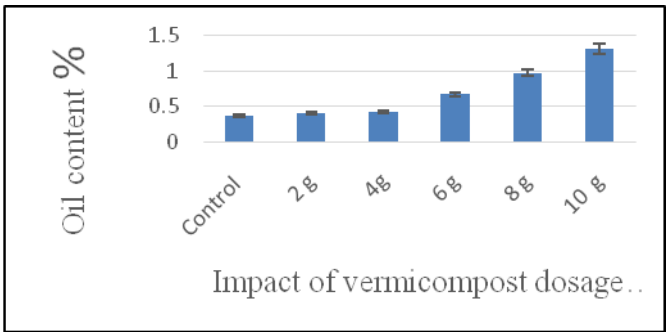


Figure 6: Effect of compost at different levels of dosage on content of lemongrass oil attribute.



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