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Journal of Agriculture & Education Research

Research Article

Effect of Different Media on Growth and Yield of Desi Mint (Mentha Arvensis)

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Received: 2024 Feb 16 **Accepted:** 2024 Mar 06 **Published:** 2024 Mar 15

Abstract

The research was conducted at Ornamental Nursery, Department of Horticulture, The University of Agriculture Peshawar during 2020-21. The study was laid out according to completely randomized design (CRD) with three replicates. Four treatments were used in the experiment. Results obtained for various growth, yield and chemical parameters. Data obtained for different parameters of plants showed significant results. The results showed minimum plant height, leaf diameter, number of leaves, number of branches, fruits per inflorescence, fresh weight of plant, dry weight of plant, root Length of plant, root weight of plant and canopy size/spread were examined in treatment T_0 (Soil) while maximum was noticed in case of T_2 (Soil + leaf compost), followed by T_0, T_1, T_2 and T_3. Analysis of variance for Mint oil content revealed significant results. The minimum oil content was examined in treatment T_0 (Soil) while maximum was noticed in case of T_1 (Soil + Leaf compost), followed by T_0, T_1, T_2 and T_3. Observation regarding Menthol content in plant revealed significant effect on sowing media. Menthol content was minimum in treatment T_0 (Soil) while maximum was noticed in case of T_2 (Soil+ leaf compost), followed by T_0, T_1, T_2 and T_3.

Keywords: Mint, Mentha Arvensis, Media, Yield, Growth.

1. Introduction

Mint is a genus of perennial aromatic herbs oral family, distributed mostly in the temperate and semi-temperate regions of the world and includes a large number of species, including M. arvensis L. The production of aromatic species for essential oils is of great economic importance, mainly due to the increased demand resulting from food, cosmetics and pharmaceutical industries. Among the many aromatic species, menthol mint has a great demand in the market. Moreover, essential oils perform multiple roles for plants, but can be engaged mainly in environmental interactions between species [1]. The Mint plants are used to soothe nausea, flatulence, headache and vomiting because of their aromatic, stimulant, stomachic and carminative effects. Mint is also used for mouthwashes, soaps, chewing gum, sweets, sweets and alcoholic refreshments. Mint has many biological properties, being antibacterial, antifungal and insects [2, 3]. Mentha arvensis L. (mint) is a plant essential oil effect is important well-crystallized menthol essential oil, de mentholated oil and fractions thereof specific terpenes are used widely in the food, flavor, pharmaceutical and cosmetics [4]. Mint is grown in different agro-ecological zones of Pakistan and is used to make sauces and chatni in more than a home hold. Annual consumption of various herbs divided into four categories and found that mint leaves long sold more than 200 thousand tons per year. Harvest mint leaves can be ready at any time [5]. Mint prefers rich, moist soil with a slightly acidic pH between 6.5 and 7.0. Mints are often perennial it produces suckers; mints types multiply both by reproductive and vegetative. In crops of mint, is to maintain the purity of plant varieties by generating Sum. The distribution of the types of mint on a large scale and prone to attack by a variety of diseases and pests. Many laboratories around the world are carrying out research and development on species of mint some improvement in the yield and quality of essential oils, and the integration of the disease, tolerance and pest control and increase productivity [6].

Composting of organic materials "exogenous" to the soil, such as municipal and industrial sources and agriculture, and is recommended in the strategic objective of soil by the European Union Commission to promote. This is an effective way to ensure the quality of the biomass back into the soil, so as to cope with the loss of soil organic matter [7]. And looks at the composting of municipal solid waste as a strategy to convert organic waste from landfills by creating suitable for agricultural purposes product at relatively low cost. In the safe use in agriculture depends on its quality, referring specifically to compost maturity, and low metal and salt contents [8]. A source familiar with the separation of food waste and the exclusion of municipal sewage sludge is a cornerstone in improving the quality of compost municipal waste and reduce the mineral content of the [9].

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Compost is homogeneous, retains most of the original food, and reduced levels of persistent organic pollutants, because decompose before use [10]. It can be applied to raise the matter and nutrients that can be released to the decomposition of soil organic matter, improve soil structure and increase the capacity for cation exchange. The use of fertilizers in the soil is the practice is widespread and well-known positive effects on the soil and vegetables from several studies [11-14]. Some species of earthworms can waste organic materials to break up minute particles that pass through the viscera grinding [15]. Containing earthworms process materials "cast" in the forms of food readily available to plants [16, 17]. Greenhouse and field studies have examined the effects of Fermi compost on grain and legumes and vegetables and field crops [14, 12, 18].

The harmful effects of chemical fertilizers and pesticides turned toward the interests of researcher's organic amendments such as compost Fermi, which can increase crop production and prevent them from harmful pests without polluting the environment. Fermi composted manure is not only a valuable agent of biological control, but also an effective way to manage solid waste. In terms of improving soil health, vermicomposting is better than other methods for the management of solid waste, such as traditional composting and landfill. Landfill is expensive and can lead to wash the toxic compounds [19, 20].

2. Materials and Methods

2.1. Experimental Site

The location for this experiment was the Ornamental Horticulture nursery, Department of Horticulture, the University of Agriculture Peshawar. This experiment was performed under the partial shade in pots having a length of 0.6 feet with 0.4 feet width of each. Mint (Mentha arvensis L.) plants were collected from reliable source. The filled pots were placed in a partial shade where mint plants were transplanted. Pots were placed in the furrows made in the tunnel. There were four treatments and each treatment were replicated three times.

2.2. Materials

Mint variety (Mentha arvensis L.), Pots, soil, Farmyard manure, leaf compost and rice husk.

2.3. Methodology

The treatments which were examined are as fallows;

T0: Soil (100% by volume)

- T1: Soil + farmyard manure (50% soil and 50% farm yard manure).
- T2: Soil + leaf compost (50% soil and 50% leaf compost).
- T3: Soil + rice husk (50% soil and 50 % rice husk).

Each treatment had 3 replications. A completely randomized design (CRD) was applied as treatments are in controlled environment. Before transplanting pots were irrigated to moisten and settle down the media. After transplanting, again the water was added in pots for the anchorage of plants. Later irrigations were given to plants keeping in view the moisture conditions in pots. The data which includes plant height, leaf diameter and canopy size/spread was taken on monthly basis. At end, the media effects on growth rate, number of leaves per plant, number of branches per plant, fresh weight of plant, dry weight of plant, root length, mint oil extraction and menthol estimation was analyzed. The data collected was subjected to statistically analysis to check the significance difference among the treatments as recommended by [21].

2.4. Studied Parameters

Data were recorded on Plant Height (cm), leaf diameter (leaf diameter was recorded with measuring tape), Number of leaves plant-1, Number of branches plant-1, Fresh weight of plant (g), Dry weight of plant (g) (fresh and dry, Length of root of plant (cm), Root weight of plant (g) (root weight of plant was measured with a digital balance (Hytek SF-400C), Canopy size/spread (cm), Essential oil (ml/100g) (Mentha oil is derived by steam distillation of Mentha leaves, the basic raw material required for the production of menthol. To isolate and measure essential oil concentration, the mint leaves (50 g) were dried at +30 °C and then mixed with 700 ml of water, which was subsequently hydro distilled for 2 h at 120 °C at atmospheric pressure), Menthol content (g/mol) (Menthol is an organic compound made synthetically or obtained from mint oils. It is a waxy, crystalline substance, clear or white in color, which is solid at room temperature and melts slightly above).

- Formula: C10H20O
- Molar mass: 156.27 g/mol
- Boiling point: 212 °C
- IUPAC ID: (1R,2S,5R)-2-isopropyl-5-methylcyclohexanol
- Melting point: 31 °C
- Density: 890 kg/m^3.

2.5. Statistical Analysis

The collected data were analyzed with the help of STATISTIX 8.1 (statistical software) using the analysis of variance (ANOVA) technique ([22]. In case of significant differences, the means were separated further using the least significant difference (LSD) test [23].

3. Results and Discussion

3.1. Plants Height After Transplanting

In this parameter, data were collected and analyzed by statistical analysis of variance. These results are presented in figure 1 which exposed significant results for the treatments and showed maximum height in T_2 (Soil + Leaf Compost) (27.553 cm) followed by T_1 (Soil + farmyard manure) (23.087 cm) and T_3 (Soil + Rice husk) (22.180cm) while least height was recorded in T_0 (Soil).

Hence, the Plant height was recorded maximum in T_2 which was a media with the mixture of soil and leaf compost and minimum height was recorded in T_0 which was a media of soil. These results are similar results with the Chrysanthemum which showed more plant height when grown in compost mixture [24].

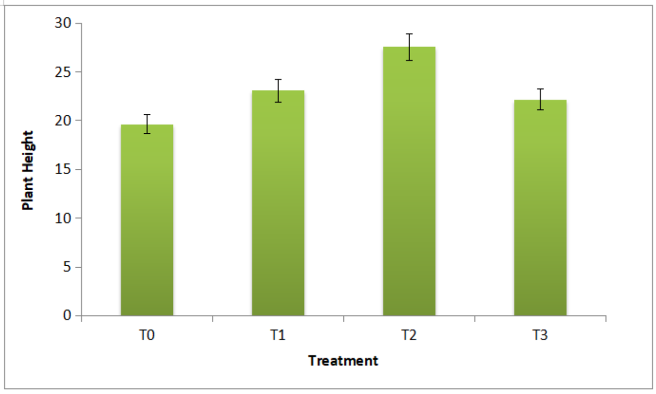

Figure 1: Effect of Different media on plant height (cm). Significant at P≤0.001, 0.01, 0.05 respectively, T_0: Soil, T_1: Soil + farmyard manure, T_2: Soil + leaf compost and T_3: Soil + rice husk.

3.2. Leaf Diameter (cm²)

In this parameter, data were collected and analyzed by statistical analysis of variance. These results are presented in figure 2 which exposed significant results for the treatments. Showed maximum leaf diameter in T_2 (Soil + Leaf Compost) (3.45 cm²) followed by T_1 (Soil + FYM) (3.09 cm²) and T_3 (soil + Rice Husk) (2.38 cm²) while least leaf diameter was recorded in T0 (Soil).

Hence, the Leaf diameter was recorded maximum in T_2 which was a media with the mixture of soil and leaf compost and minimum leaf diameter was recorded in T_0 which was a media of soil. These results are similar results with the Peppermint which showed more plant leaf diameter when grown in compost [25].

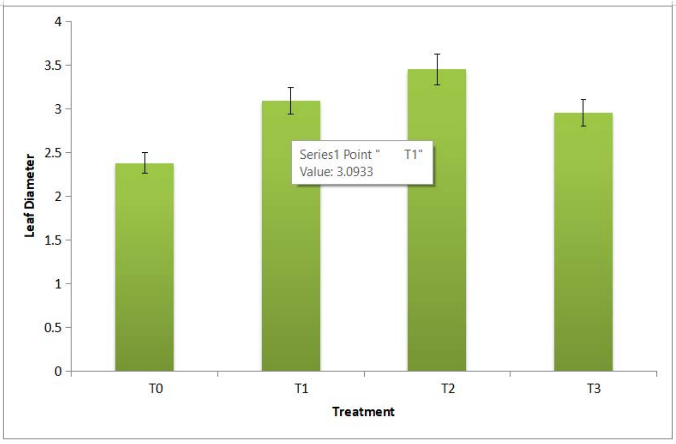

Figure 2: Effect of Different media on Leaf Diameter (cm²). Significant at P≤0.001, 0.01, 0.05 respectively, T_0: Soil, T_1: Soil + farmyard manure, T_2: Soil + leaf compost and T_3: Soil + rice husk.

3.3. Number of Leaves Per Plant

In this parameter, data were collected and analyzed by statistical analysis of variance. These results are presented in figure 3 which exposed significant results for the treatments and showed maximum number of leaves/plant in T_2 (Soil + Leaf Compost) (106) followed by T_1 (Soil + farmyard manure) (82) and T_3 (Soil + Rice husk) (59) while least number of leaves was recorded in T_0 (Soil).

Hence, the Number of leaves per plants was recorded maximum in T_2 which was a media with the mixture of soil and leaf compost and minimum number of leaves per plant was recorded in T_0 which was a media of soil. These results are similar results with the Lettuce which showed a greater Number of leaves/plant when grown in compost mixture [26].

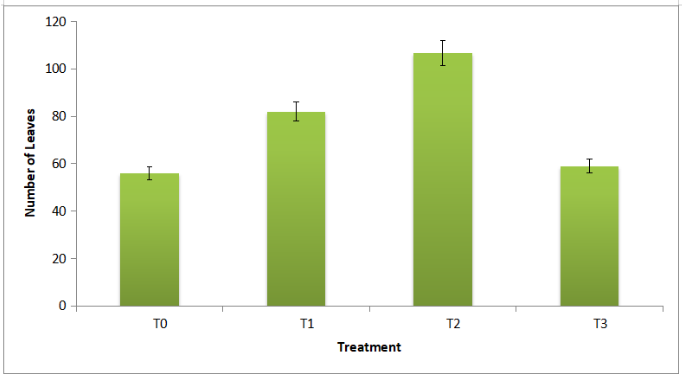

Figure 3: Effect of Different media on Number of Leaves per plant. Significant at P≤0.001, 0.01, 0.05 respectively, T0: Soil, T1: Soil + farmyard manure, T2: Soil + leaf compost and T3: Soil + rice husk.

3.4. Number of Branches Per Plant

In this parameter, data were collected and analyzed by statistical analysis of variance. These results are presented in figure 4 which exposed significant results for the treatments and showed maximum average number of branches per plant in T_2 (Soil + Leaf Compost) (7.33) followed by T_1 (Soil + farmyard manure) (5.33) and T_3 (Soil + Rice husk) (4.33) while least average number of branches per plant was recorded in T_0 (Soil).

Hence, the Number of branches per plant was recorded maximum in T_2 which was a media with the mixture of soil and leaf compost and minimum number of branches per plant was recorded in T_0 which was a media of soil. These results are similar results with the peppermint and orange mint which showed a greater Number of branches when grown in compost basal medium [27].

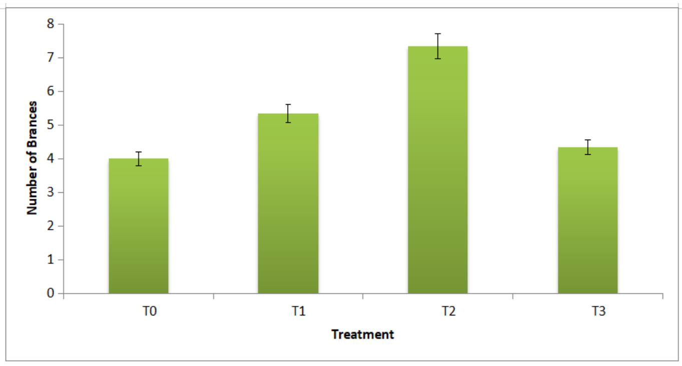

Figure 4: Effect of Different media on number of Branches per plant. Significant at P≤0.001, 0.01, 0.05 respectively, T_0: Soil, T_1: Soil + farmyard manure, T_2: Soil + leaf compost and T_3: Soil + rice husk.

3.5. Fresh Weight of Plant (g)

In this parameter, data were collected and analyzed by statistical analysis of variance. These results are presented in figure 5 which exposed significant results for the treatments and showed maximum fresh weight in T_2 (Soil + Leaf Compost) (14.150 g) followed by T_1 (Soil + farmyard manure) (12.987 g) and T_3 (Soil + Rice husk) (10.357 g) while least fresh weight was recorded in T_0 (Soil).

Hence, the Fresh weight of plant was recorded maximum in T_2 which was a media with the mixture of soil and leaf compost and minimum fresh weight of plant was recorded in T_0 which was a media of soil. These results are similar results with the mint which showed more plant fresh weight when grown in compost mixture [28].

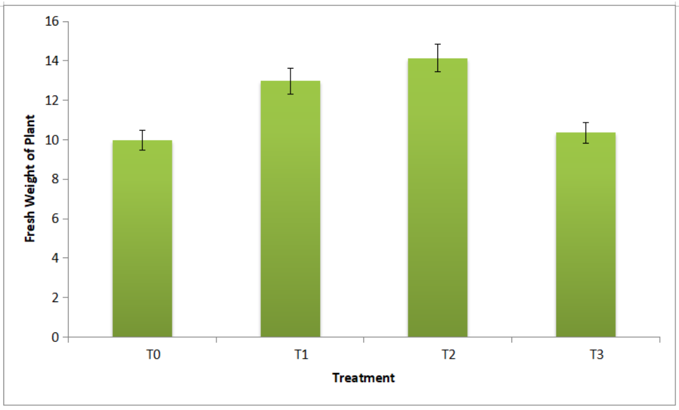

Figure 5: Effect of Different media on Fresh Weight of plant (g). Significant at P≤0.001, 0.01, 0.05 respectively, T_0: Soil, T_1: Soil + farmyard manure, T_2: Soil + leaf compost and T_3: Soil + rice husk.

3.6. Dry Weight of Plant (g)

In this parameter, data were collected and analyzed by statistical analysis of variance. These results are presented in figure 6 which exposed significant results for the treatments and showed maximum dry weight of plant in T_2 (Soil + Leaf Compost) (2.94 g) followed by T_1 (Soil + farmyard manure) (2.59 g) and T_3 (Soil + Rice husk) (2.33 g) while least plant dry weight was recorded in T_0 (Soil).

Hence, the dry weight of plant was recorded maximum in T_2 which was a media with the mixture of soil and leaf compost and minimum dry weight of plant was recorded in T_0 which was a media of soil. These results are similar results with the peppermint and basil which showed more plant dry weight when grown in compost mixture [29].

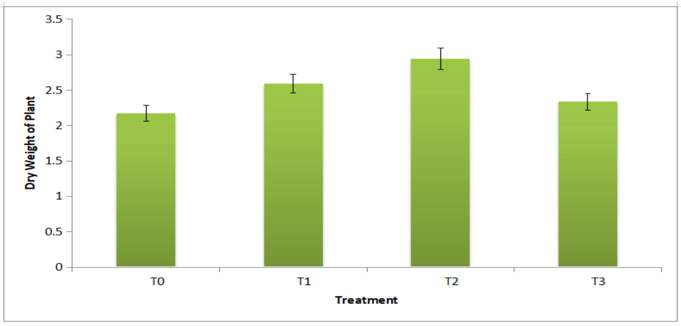

Figure 6: Effect of Different media on Dry Weight of Plant (g). Significant at P≤0.001, 0.01, 0.05 respectively, T0: Soil, T1: Soil + farmyard manure, T2: Soil + leaf compost and T3: Soil + rice husk.

3.7. Root Length of Plant (cm)

In this parameter, data were collected and analyzed by statistical analysis of variance. These results are presented in figure 7 which exposed significant results for the treatments and showed maximum root length of plant in T_2 (Soil + Leaf Compost) (19.9 cm) followed T_3 (Soil + Rice husk) (17.3 cm) and by T_1 (Soil + farmyard manure) (16.3 cm) while least root length of plant was recorded in T_0 (Soil).

Hence, the Root length of plant was recorded maximum in T_2 which was a media with the mixture of soil and leaf compost and minimum root length of plant was recorded in T_0 which was a media of soil. These results are similar results with the Mentha piperita L. which showed more root length of plant when grown in compost mixture [30].

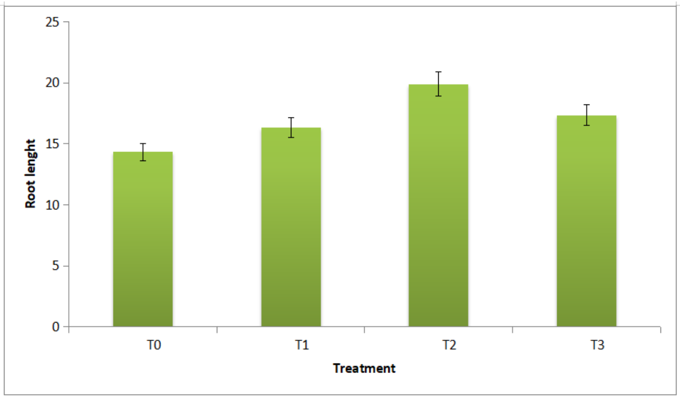

Figure 7: Effect of Different media on Root Length (cm). Significant at P≤0.001, 0.01, 0.05 respectively, T_0: Soil, T_1: Soil + farmyard manure, T_2: Soil + leaf compost and T_3: Soil + rice husk

3.8. Root Weight of Plant (g)

In this parameter, data were collected and analyzed by statistical analysis of variance. These results are presented in figure 8 which exposed significant results for the treatments and showed maximum root weight of plant in T_2 (Soil + Leaf Compost) (0.1540 g) followed by T_1 (Soil + farmyard manure) (0.1270 g) and T_3 (Soil + Rice husk) (0.1233 g) while least root weight was recorded in T_0 (Soil).

Hence, the Root weight of plant was recorded maximum in T_2 which was a media with the mixture of soil and leaf compost and minimum root weight of plant was recorded in T_0 which was a media of soil. These results are similar results with the Tomato which showed more root weight of plant when grown in compost mixture [26].

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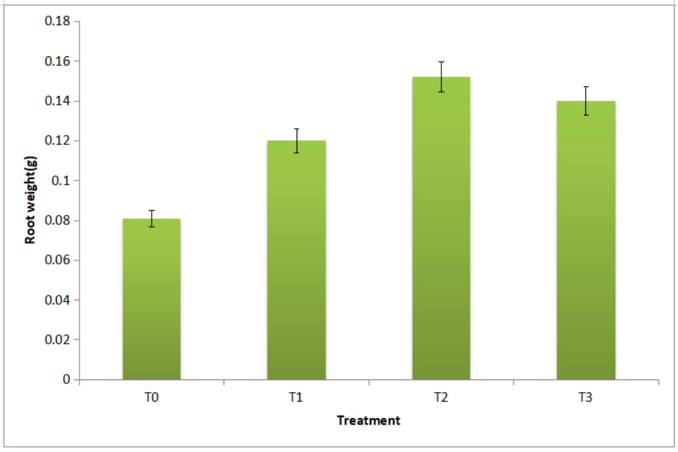

Figure 8: Effect of Different media on Root Weight (g). Significant at P≤0.001, 0.01, 0.05 respectively, T_0: Soil, T_1: Soil + farmyard manure, T_2: Soil + leaf compost and T_3: Soil + rice husk.

3.9. Canopy Size/Spread (cm)

In this parameter, data were collected and analyzed by statistical analysis of variance. These results are presented in table 1 which exposed significant results for the treatments and showed maximum canopy size in T_2 (Soil + Leaf Compost) (28.37 cm) followed by T_1 (Soil + farmyard manure) (23.60 cm) and T_3 (Soil + Rice husk) (21.02 cm) while least canopy size was recorded in T_0 (Soil). Hence, the canopy spread was recorded maximum in T_2 which was a media with the mixture of soil and leaf compost and minimum canopy size was recorded in T_0 which was a media of soil. These results are similar results with the lettuce which showed more canopy spread when grown in compost [31].

Table: 1 Comparison of treatments for Plant Canopy (cm).

Treatment	Mean (T)
T_0	19.607 C
T_1	23.607 B
T_2	28.373 A
T_3	21.020 BC
Mean (T)	1.1726
LSD	Treatments = 2.7040

**, **, * = Significant at P≤0.001, 0.01, 0.05 respectively, NS = Non-significant, T_0: Soil, T_1: Soil + farmyard manure, T_2: Soil + leaf compost and T_3: Soil + rice husk.

3.10. Essential Oil Extraction (ml/100g)

The variations in oil content for mint of different media were statistically significant (P=0.05). The result showed in figure 9. The maximum amount of oil was obtained T_2 (leaf compost + soil) (0.6000 ml/100g) and the minimum oil content was measured for T_0 (soil) (0.2700 ml/100g). While T_1 (FYM + Soil) produce (0.3733 ml/100g) of oil and T_3 (rice husk+ soil) was (0.3600ml/100g).

These results are similar results with Peppermint which showed oil percentage when grown in drought stress [32].

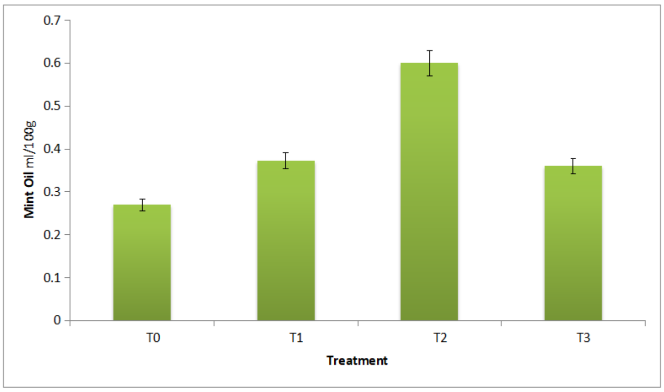

Figure 9: Effect of Different media on Essential Oil (ml/100g). Significant at P≤0.001, 0.01, 0.05 respectively, NS = Non-significant, T_0: Soil, T_1: Soil + farmyard manure, T_2: Soil + leaf compost and T_3: Soil + rice husk.

3.11. Menthol Content (g/mol)

In this parameter, data were collected and analyzed by statistical analysis of variance. These results are presented in figure 10 which exposed significant results for the treatments and showed maximum menthol content in T_2 (Soil + Leaf Compost) (1.00 g/100g1) followed by T_1 (Soil + farmyard manure) (0.6 g/100g1) and T_3 (Soil + Rice husk) (0.5 g/100g1) while least contents were recorded in T_0 (Soil).

Hence, the menthol content was recorded maximum in T_2 which was a media with the mixture of soil and leaf compost and minimum menthol content was recorded in T_0 which was a media of soil. These results are similar results with the Pepper mint oil which showed more menthol content when grown in compost mixture [33, 34].

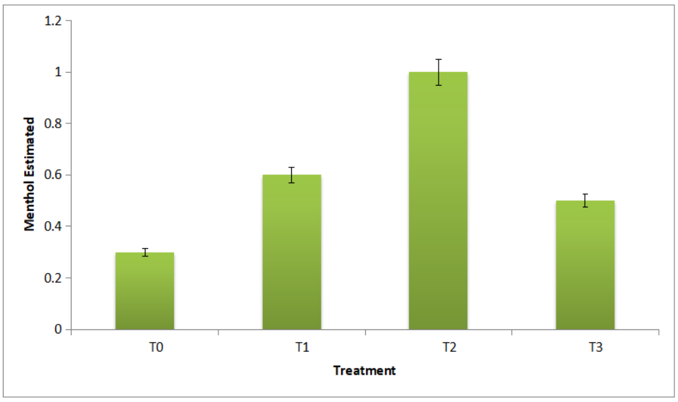

Figure 10: Effect of Different media on Menthol content (g/mol). Significant at P≤0.001, 0.01, 0.05 respectively, T0: Soil, T1: Soil + farmyard manure, T2: Soil + leaf compost and T3: Soil + rice husk.

4. Conclusion

The minimum plant height, leaf diameter, number of leaves, number of branches, fruits per inflorescence, fresh weight of plant, dry weight of plant, root Length of plant, root weight of plant, canopy size/spread, oil content and Menthol content were examined in treatment T_0 (Soil) while maximum was noticed in case of T_2 (Soil + leaf compost), followed by T_0, T_1, T_2 and T_3. All studied parameters of plants showed significant results.

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