

Effects of Agronomic practices on *Ocimum basilicum* L. (Sweet Basil)

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ABSTRACT

Ocimum basilicum, belongs to the family Lamiaceae is commercially cultivated as a condiment i.e., for the production of essential oil. Other medicinal uses are to treat vomiting, diarrhea, various pains, and intestinal colic, improve kidney function and hyperlipidemia. The *Ocimum basilicum* L. has neuro-protective, antioxidant, vasodilator, anti-inflammatory and hepato-protective effects. In the present day concern due to shortage of land availability people are more interested towards soilless cultivation. So pot experiment along with different soil and soilless treatment i.e., compost, cow dung, acidified manure, bagasse and rice husk, each having five replicates, at different ratio, was conducted in randomized complete block design (RCBD). The main objective of the study was to observe the growth behavior of *Ocimum basilicum* with different treatments. According to the results, all treatments such as cow dung (CD), compost (CP), acidified manure (AM), bagasse (BG), rice husk (RH) showed positive effects on root and shoot length of plants. The study revealed that in the prevailing climatic condition of Dera Gazi Khan, Punjab, Pakistan, it is possible to obtain a high yield of basil herb using an organic farming system. The study suggested that organic fertilizers should be the best alternative of synthetic or inorganic fertilizers. The study explored that the basil plants respond with all their growth parameters as better in treatments with organic materials like cow dung, composts, manure etc. So the experiments must raise the appeal to avoid the inorganic fertilizers for the protection of soil fertility and survival of cultivated plants.

Keywords: Sweet basil · *Ocimum basilicum* L. · Compost · Agronomic treatments · Medicinal plants · Block design

1. Introduction

Sweet Basil (*Ocimum basilicum* L.) of the Lamiaceae family is one of the most diffused aromatic plants involved in the production of essential oils and fragrances for the nutraceutical sector. The extracted essential oils from *Ocimum* genus has also been shown to contain biologically active constituents that are insecticidal, fungicidal and nematicidal in nature. *Ocimum basilicum* (basil) has been utilized as a source and as a society solution for the treatment of sicknesses. The plant is considered as effective for the treatment of numerous infections. This plant, which contains 50 to 150 species, belongs to the family Lamiaceae and is found in tropical Asia, Africa, North America and South America. Among all the types, the *Ocimum basilicum* L. is the one most generally developed plant having economic value for its green and sweet-smelling leaves, which are utilized dry or fresh as a topping or for the creation of fundamental oil. Since society today favors normal food added substances, normally inferred antimicrobial specialists, for example, basil are acquiring expanding significance in antimicrobial bundling [1–5].

Basil is customarily utilized worldwide as a restorative spice to treat various infirmities. The leaves and blooming parts are customarily utilized as antispasmodic, sweet-smelling, carminative, and stomach related cures, and to treat stomach cramps, gastro-enteritis, fever, queasiness, headaches, a sleeping disorder, gloom and looseness of the bowels etc. They have been applied remotely to treat skin inflammation, bug stings and skin contaminations [6, 7]. The significant expense of drug/medicine has prompted an expanding look for elective prescriptions to treat various sicknesses, which are generally simpler to discover and

more affordable. Considering this pattern, there is a requirement for contemplates affirming the impacts of therapeutic plants and phytotherapeutic items. The motivation behind this survey is to show that numerous examinations have exhibited that *Ocimum basilicum* has different useful impacts on wellbeing and that it has the right to be investigated all the more broadly in clinical preliminaries for use in avoidance and treatment, or as an adjuvant in the treatment of various issues. The main objective of the research was to study the growth behaviour of *Ocimum basilicum* in different media in relation to local soil.

2. Materials and Methods

2.1 Site selection

A pot experiment of Sweet basil (*Ocimum basilicum*) on different treatments was conducted in district Dera Ghazi Khan between 28° – 25' and 31° – 21' N latitude 69° – 20' and 70° – 51' E longitude with an elevation of 129m above the sea level, during last 3 weeks of June 2021.

2.2 substrate preparation

A standard plastic pot size (1Kg) was filled with different media and fertile soil (0.6 Kg each), four healthy seeds of Sweet basil of almost same size were sown in pots. Substrate or the medium which is applied to grow plants is commonly called the growing medium. Plantation was such that there were different treatments such as cow dung (CD), compost (CP), acidified manure (AM), bagasse (BG), rice husk (RH) and one treatment of fertile soil (FS), as

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a control. Initially, all treatments were applied in open environment, with restricted water supply and later, were transferred to undercover area. Same agronomic practices were applied on all the treatments.

2.3 Experimental plan

The RCBD is the standard design for agricultural experiments was applied in this study where similar experimental units are grouped into blocks or replicates. The experiment was laid out in randomized complete block design (RCBD) with six (06) treatments and five (05)

replications of each treatment. Treatments were applied in pots and then these pots were irrigated according to the requirements and climatic conditions. All the pots were placed under shade.

2.4 Agronomic treatments

Different agronomic treatments such as bagasse (BG), cow dung (CD), compost (CM), acidified manure (AM), rice husk (RH) were applied in this study. Preparations of different agronomic treatments are presented in Table 1.

Table 1 Preparations of different agronomic treatments included

Sl No.	Treatment	Media (g)
1	T1	Fertile soil-400g
2	T2	Bagasse (BG)140+Fertile Soil(FS) 260g
3	T3	Cow dung (CD) 140 g+ Fertile Soil(FS) 260g
4	T4	Compost (CM) 140g + Fertile Soil(FS) 260g
5	T5	Acidified Manure (AM) 140g + Fertil Soil(FS) 260g
6	T6	Rice Husk (RH) 140g + Fertile Soil (FS) 260g

2.5 Growth parameters of *Ocimum basilicum*

Several growth parameters of *Ocimum basilicum* under different media cultivation were measured by investigating and monitoring average plant root length, shoot length, total number of leaves pot⁻¹, fresh/dry weight of plant etc.

2.6 Plants Sampling and Measurements

Plant sampling and measurement were carried out 20 days after sowing. The seeds of Sweet basil for the determination of plant shoot length, root length, number of leaves and for the determination of fresh and dry weight were taken for the experimental study.

2.6.1. Root length and shoot length

The root length of the plants was taken with the help of scale. It was measured from base to end. The shoot of the plant was measured from experimental pots. It was taken from base to tip.

2.6.2. Number of leaves per plant

The number of leaves per plant of sweet basil was taken accordingly and measured by counting the leaf from each plant (*Ocimum basilicum*).

2.6.3. Fresh weight and Dry weight of plant

The fresh weight was measured by using electrical balance whereas plants were oven dried and then the weight was taken by using sensitive electrical balance to measure the dry weight of plants.

3. Results and Discussion

Basil is native to India and different tropical areas stretching from Africa to Southeast Asia, however has now end up globalized due to human cultivation.

Basil is being used in folk medicine to treat vomiting, intestinal colic and diarrhea, menstrual pains and sterility, improve kidney function, and to relieve the coughing, bronchitis and hoarseness typically generated in colds and flu [7]. Essential oil is accumulated in leaves and flowers of basil and other aromatic plants that have been used for many purposes [8–12] and also have a great importance on agriculture. The literature related to this study contains many researches on *Ocimum basilicum*, in addition to its traditional uses in folk medicine. Medicinal use of the essential oils that have many uses is also widely reported [13–15].

3.1. Root length per plant

The effect of different media cultivation on the root length of the Sweet basil plants are presented in Figure.1.

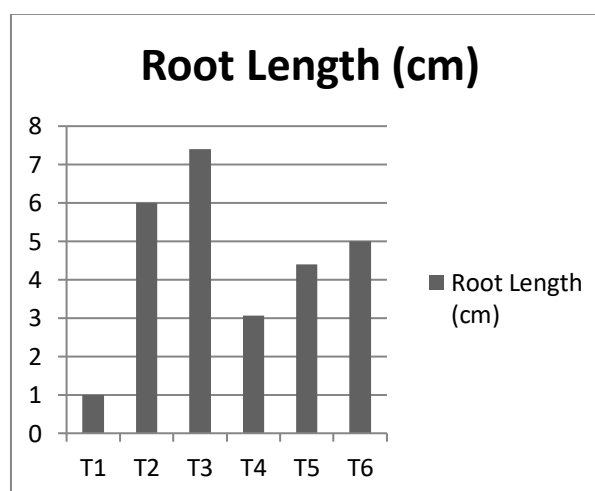


Fig. 1. Effect of different media cultivation on the root length of plant

The root length of Basil under different treatments was different in the order of $T_3 > T_2 > T_6 > T_5 > T_4 > T_1$. The longest recorded root length i.e., ~ 7.4 cm, of Sweet basil was observed, under cow dung cultivation (T_3), while the shortest i.e., 1 cm was under fertile soil (7:3) cultivation (T_4). According to the results, all treatments such as cow dung (CD), compost (CP), acidified manure (AM), bagasse (BG), rice husk (RH) showed positive effects on root length of plants.

3.2. Shoot length per plant

The shoot length of Basil under different media was different in the order of $T_3 > T_2 > T_5 > T_6 > T_4 > T_1$. The result showed that the shoot length per plant ranged between 13.5cm to 1.34 cm in applying different treatments and the maximum shoot length was obtained in T_3 (13.5cm) and the minimum shoot length was in T_1 (1.34cm) shown in figure 2. According to the results, all treatments such as cow dung (CD), compost (CP), acidified manure (AM), bagasse (BG), rice husk (RH) showed positives effects on shoot length of plants.

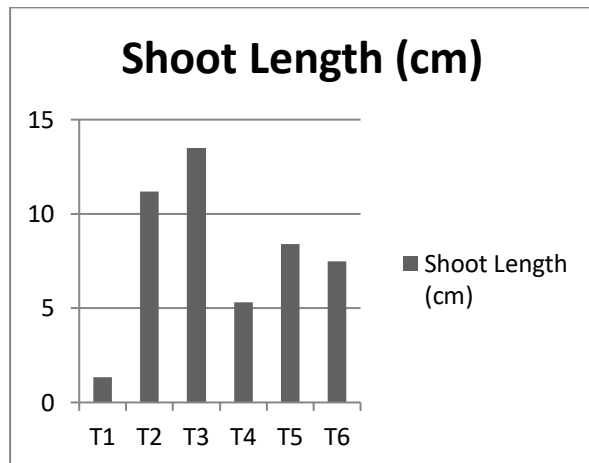


Fig. 2. Effect of different treatments on shoot length

3.3. No. of leaves per plant

The number of leaves of sweet basil per plant (Fig. 3) in

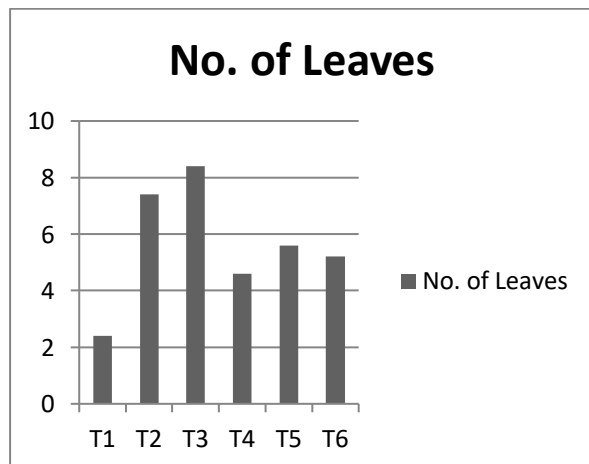


Fig. 3. Effect of different treatments on number of leaves

different treatments was different in the order of $T_3 > T_2 > T_5 > T_6 > T_4 > T_1$. The results showed that the number of leaves per plant ranged between 8.4 to 2.4 and the maximum number of leaves was counted in T_3 (8.4) and the lowest number of leaves in T_1 (2.4).

3.4. Fresh weight per plant

The Fresh weight per plant of Basil under different treatments was different in the order of $T_2 > T_3 > T_5 > T_6 > T_4 > T_1$. The result show that the fresh weight per plant ranged between 6.46g to 0.42 g and maximum fresh weight 6.46gm by treatment T_2 and the lowest was measured by treatment T_1 on the basis of data from figure 4.

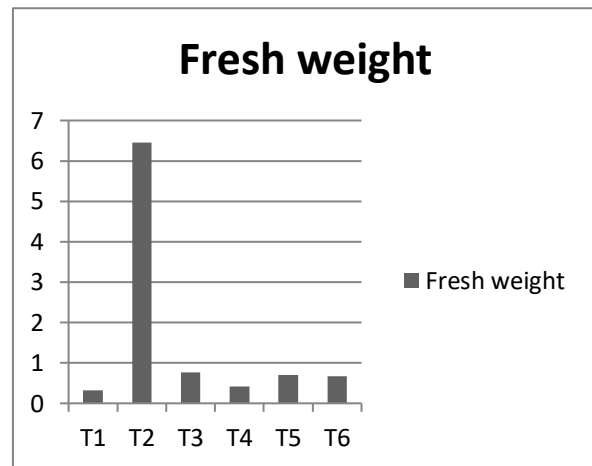


Fig. 4. Effect of different treatments on fresh weight

3.5. Dry weight per plant

The Fresh weight per plant (Fig. 5) of Basil under different media was different in the order of $T_2 > T_3 > T_5 > T_6 > T_4 > T_1$. The results show that the dry weight per plant ranged between 0.96g to 0.12g and the maximum dry weight 0.96g by treatment T_2 and the minimum treatment 0.12g by treatment T_1 . According to the results, all treatments such as cow dung (CD), compost (CP), acidified

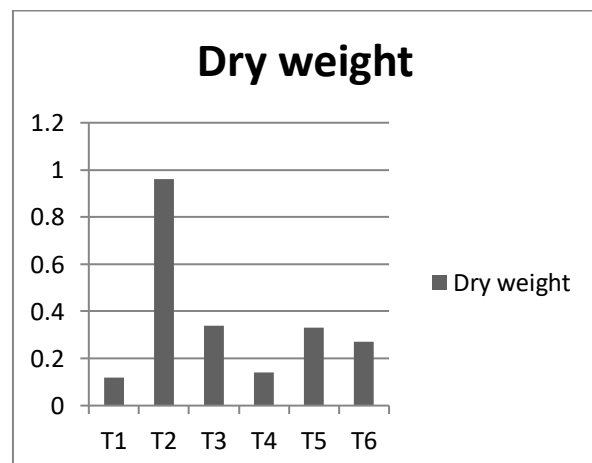


Fig. 5. Effect of different treatments on dry weight

manure (AM), bagasse (BG), rice husk (RH) showed positive effect on dry weight of plants. It is possible that increased application rate could be increased the fresh weight per plants. Adding organic manures in soil improve soil biological and physical conditions and create a more favorable environment for growth of roots and nutrients availability, increased plant growth and dry matter. The data given in the graphs showed that the all the treatments exhibited better results than the fertile soil. The present study reflected that the application of various plant fertilizers promotes the growth parameters of the Sweet basil (*Ocimum basilicum*). Similar observation was made by various researchers [16-18] and reported that organic or conventional fertilizer can alter/increase yield, fresh or dry weight of sweet basil. The control one showed poor results. They just germinate but did not propagate well. Then bagasse showed better result than control soil. The result of cow dung was even better than both bagasse and fertile soil. Compost treatment also showed better result. The plants with the treatment of acidified manure were better than all of above mentioned treatments. According to the results, all treatments such as cow dung (CD), compost (CP), acidified manure (AM), bagasse (BG), rice husk (RH) showed positive effect on all the plant growth parameters.

4. Conclusion

The study reflects that the application of cow dung, bagasse, compost, acidified manure and the rice husk promotes the growth parameters of the Sweet basil (*Ocimum basilicum*). Also the application of these treatments gives the resistance to the sweet basil to survive in the harsh environmental conditions. The results of the study presented above indicated that, in the climatic condition of Dera Gazi Khan, Punjab, Pakistan, is possible to obtain a high yield of basil herb using an organic farming system. In these conditions, the herb was characterized by different growth behaviors like root-shoot length, number of leaves per plant, fresh and dry weight etc. According to the results, all treatments such as cow dung (CD), compost (CP), acidified manure (AM), bagasse (BG), rice husk (RH) showed positive effects on root and shoot length of *Ocimum basilicum*. Application of cow dung is eco-friendly. As inorganic fertilizers are expensive and have a great toxic effect on soil properties. So, it is suggested that organic fertilizers should be used on priority. From the study it can be decided that the basil plants respond with all their growth parameters as better in treatments with organic materials like cow dung, composts, manure etc. The study recommended that the application of organic fertilizers instead of inorganic/synthetic fertilizers will be considered as inevitable for the protection and survival of soil fertility and cultivation of plants.

Conflict of interest

The authors declare that there is no conflict of interest in this manuscript.

Data availability

The authors confirm that all data collected or analyzed during this study are included in this published article.

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