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Studies on effect of organic manures on growth and yield parameters of sweet basil (*Ocimum basilicum* L.) under Telangana

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Abstract

The present investigation on “Studies on effect of organic manures on growth, yield and quality of Sweet basil (*Ocimum basilicum* L.)” was conducted at Medicinal and Aromatic Plants Research Station, Rajendranagar, SKLTSHU, Mulugu during 2020-21. The experiment was laid out in Randomized block design (RBD) with 3 replications and 11 treatments. The results revealed that among all the organic manures and their combinations, treatment T₁₀-combination of organic manures Vermicompost @ 750 Kg/ha + Farmyard Manure @ 3.75 t/ha + Neem cake @ 375 Kg/ha recorded maximum plant height (92.89 cm), number of leaves per plant (980.67), leaf area (4268.67 cm²), number of days taken for initiation of flowering (45.20), number of inflorescences per plant (66.61), fresh yield per hectare (132.15 q) and seed yield per hectare (630.00 Kg).

Keywords: FYM, vermicompost, neem cake, growth, yield

Introduction

Basil (*Ocimum basilicum* L.) is an important species of cultivated aromatic and medicinal plants belonging to the Lamiaceae (Mint family). This family Lamiaceae includes about 3,200 species of annuals and non woody perennials which are widely distributed almost all over the temperate and tropical regions of the world.

Basil is usually referred as the “King of the herbs”, being widely utilized due to its economic, culinary, industrial, and medicinal importance. An extract of the herb is used in preventing cardiovascular diseases through improved diet and several antioxidant compounds it contains display a high antioxidant power. The extracts have been shown to display important effects at the cellular level, including a platelet antiaggregant property and inhibitory activity against HIV to decrease plasma lipid content (Abraham. A *et al.*, 2018) [1].

An important factor affecting the quantity and quality of the French basil yield may be fertilization. Plant nutrition is closely connected to the quantity and quality to obtain yield, besides its yield creating role, also affects the biological value. Nowadays, there is an increasing consumers’ demand for organic MAPs products. Organic cultivation of MAPs adds to their quality, which is associated to their essential oil content or other secondary metabolites (Sarrou. E *et al.*, (2016) [21].

Nowadays, chemical fertilizers are indiscriminately used to boost up the agricultural production. This has drained the soil and a gradual loss of soil productivity while organic fertilizers paved the way to replenish the essential nutrients for improving soil health and crop productivity. Nutrient management through organic manures make a hygienic and beneficial way of disposal and utilization of waste and residues. Application of vermicompost in field crops is also gaining popularity due to its ultimate benefits to farmers. Use of farmyard manure (FYM), poultry manure, vermicompost, biofertilizers, Neem cake, etc., has become imperative in medicinal and aromatic plants to meet the nutritional and health demand of the crop.

Due to the great industrial importance of basil and aiming at the evaluation of some organic cultivation practices on medicinal and aromatic plants production, we investigated the studies on effect of organic manures on growth and yield parameter of sweet basil (*Ocimum basilicum* L.) under Telangana conditions.

Materials and Methods

The present investigation was conducted at Medicinal and Aromatic Plants Research Station,

Rajendranagar during 2020-21. The experiment was laid out in Randomized Block Design (RBD) with 11 treatments and 3 replications. The treatments used in this experiment are as follows:

- T1 - Vermicompost 1 t/ha.
- T2 - Vermicompost 2 t/ha.
- T3 - Farm yard manure 5 t/ha.
- T4 - Farm yard manure 10 t/ha.
- T5 - Neem cake 500 Kg/ha.
- T6 - Neem cake 1 t/ha.
- T7 - Vermicompost 750 Kg/ha + Farmyard manure 3.75 t/ha.
- T8 - Vermicompost 750 Kg/ha + Neem cake 375 Kg/ha.
- T9 - Farm yard manure 3.75 t/ha + Neem cake 375 Kg/ha.
- T10 - Vermicompost 750 Kg/ha + Farmyard manure 3.75 t/ha + Neem cake 375 Kg/ha.
- T11 - Control.

Data Collected

Plant height (cm)

Plant height was measured from ground level to the tip of the topmost leaf at 30, 60, 90 and 120 DAP of all the five tagged plants and the average per plant was expressed in centimeters.

Number of leaves per plant

Number of leaves per plant in each treatment was counted at 30, 60, 90 and 120 DAP from the observational plants and their mean value was computed and expressed as number of leaves per plot.

Leaf area (cm²)

The leaf area of fully opened leaves per plant was measured by using leaf area meter with transparent belt conveyor utilizing an electronic digital display and expressed in cm²/plant.

Days taken for initiation of flowering

The days taken for flowering after transplanting in main field was recorded and expressed as number of days taken for initiation of flowering.

Number of inflorescences per plant

The number of inflorescences from five randomly selected plants were counted and the average was expressed as number of inflorescences per plant.

Fresh yield per hectare (q)

The yield per hectare was computed by multiplying the fresh yield per plant with the number of plants that can be accommodated in one hectare and was expressed in quintals per hectare.

Seed yield per hectare (Kg)

The number of plants per hectare was calculated and multiplied with seed yield per plant and expressed in kilograms.

Results and Discussion

The results of the present investigation regarding the response of organic manures on growth and yield parameters have been discussed and interpreted in light of previous research work in

India. The results of the experiment are summarized below and also presented in table 1.

Growth Parameters of Sweet basil

Plant height

The plant height differed significantly with treatments and increased with advancement of crop stage. The data presented in table 1 revealed that during Rabi season, At 30, 60, 90 and 120 DAP, among the treatments, the highest plant height (31.03 cm, 58.67 cm, 83.66 cm and 92.89 cm respectively) was observed with T₁₀ (Vermicompost 750 Kg/ha + Farmyard Manure 3.75 t/ha + Neem cake 375 Kg/ha) which was statistically on par with T₆ (Neem cake 1t/ha) (30.67 cm, 56.53 cm, 82.46 cm and 90.83 cm respectively) followed by T₈ (Vermicompost 750 kg/ha + Neem Cake 375 kg/ha) (29.31 cm, 55.60 cm, 80.58 cm and 88.25 cm). The lowest plant height (22.36 cm, 41.63 cm, 58.69 cm and 67.89 cm) at 30, 60, 90 and 120 DAP was recorded in T₁₁ control.

The elongation and improving of plant height may be due to the role of organic fertilizers by enhancing the cell division rate and cell enlargement. Additionally, the positive effect of combination of organic manures FYM, VC and NC on plant height can be derived from providing equilibrium plant nutrients and imposed a direct effect on number of nodes and inter nodal length that finally lead to increasing plant height. Similar results of increased plant height due to combined application of organic manures have been reported by, Pandey *et al.*, (2016) ^[14], Baraa *et al.* (2017) ^[4], Samani *et al.* (2017) ^[20], Rajit Ram *et al.*, (2019) ^[17] in different *Ocimum* sps.

Number of leaves per plant

The number of leaves per plant was significantly effected by organic manures. Among all the organic manures the treatments the maximum number of leaves per plant (288.41, 510.62, 831.41 and 980.67) at 30, 60, 90 and 120 DAP respectively were observed with T₁₀ (Vermicompost 750 Kg/ha + Farmyard Manure 3.75 t/ha + Neem cake 375 Kg/ha), and was at par with T₆ (Neem Cake 1 t/ha) (277.60, 492.28, 824.49 and 961.55). The minimum number of leaves per plant (110.40, 288.32, 581.83 and 700.62) at 30, 60, 90 and 120 DAP respectively were recorded with T₁₁ (Control).

The result revealed that the combined application of FYM, VC and NC recorded higher values. The better performance of plants with Neem cake was probably because it acted as natural fertilizer with pesticidal properties and performs as a nitrification inhibitor and prolongs the availability of nitrogen to short duration as well as long duration crops. Besides, it improves the soil condition considerably and protects the soil during the droughts. The manure provided nutrients to the plants and improved edaphic factors, which resulted in maximum number of leaves. These results are in agreement with the findings of several researchers which revealed that organic manuring increased the number of leaves. Subsequently, increasing in number of leaves might be due to cell multiplication, cell enlargement and cell differentiation which have resulted in increasing of number of leaves. These findings confirmed with the findings of Bhaba *et al.* (2018) ^[5] and Rajit Ram *et al.*, (2019) ^[17] in different *Ocimum* sps. Bajeli *et al.*, (2016) ^[3], Salem (2021) ^[19] in Japanese mint.

Table 1: Effect of Vermicompost, Farmyard Manure and Neem Cake on plant height (cm), Number of leaves per plant and Leaf area (cm²) in Sweet basil during Rabi 2020-21

Treatments	Plant height (cm)				Number of leaves per plant				Leaf area (cm ²)			
	30 DAP	60 DAP	90 DAP	120 DAP	30 DAP	60 DAP	90 DAP	120 DAP	30 DAP	60 DAP	90 DAP	120 DAP
T ₁ = Vermicompost 1 t/ha	26.90	49.33	71.83	79.90	162.99	355.27	685.67	838.13	373.60	960.00	1991.43	3179.00
T ₂ = Vermicompost 2 t/ha	27.95	51.93	75.50	84.73	188.41	290.52	721.10	860.33	394.67	986.63	2132.67	3372.00
T ₃ = Farmyard Manure 5 t/ha	24.59	45.53	67.62	78.77	140.09	306.00	625.23	767.67	340.80	916.87	1516.50	2649.93
T ₄ = Farmyard Manure 10 t/ha	25.63	49.69	70.53	80.60	45.44	338.13	663.33	804.44	356.50	942.33	1773.60	2961.87
T ₅ = Neem Cake 500 kg/ha	29.29	55.46	80.36	88.20	236.33	450.09	796.33	929.67	430.50	1126.87	2846.47	3863.23
T ₆ = Neem Cake 1 t/ha	30.67	56.53	82.46	90.83	277.60	492.28	824.49	961.55	469.93	1436.67	3260.87	4132.73
T ₇ = Vermicompost 750 kg/ha + Farmyard Manure 3.75 t/ha	28.55	51.33	73.47	81.73	202.50	410.40	747.33	892.33	408.00	994.67	2335.32	3524.33
T ₈ = Vermicompost 750 kg/ha + Neem Cake 375 kg/ha	29.31	55.60	80.58	88.25	250.55	477.83	802.67	946.33	453.42	1264.83	3094.67	4004.27
T ₉ = Farmyard Manure 3.75 t/ha + Neem Cake 375 kg/ha	28.79	51.89	75.13	83.36	221.29	432.88	775.61	905.27	426.67	1013.33	2639.67	3665.00
T ₁₀ = Vermicompost 750 kg/ha + Farmyard Manure 3.75 t/ha + Neem Cake 375 kg/ha	31.03	58.67	83.66	92.89	288.41	510.62	831.41	980.67	472.33	1473.20	3381.00	4268.67
T ₁₁ = Control	22.36	41.63	58.69	67.89	110.4	288.32	581.83	700.62	312.73	879.93	1222.33	2022.73
S.Em±	0.53	0.77	0.99	1.53	3.79	6.81	11.40	16.86	5.50	13.93	39.18	82.91
CD at 5%	1.62	2.32	2.98	4.61	11.81	20.10	33.64	49.73	17.50	41.80	121.90	258.09

Leaf Area (cm²)

Leaf area was significantly influenced due to different organic manures in pure and combined application at 30, 60, 90 and 120 DAP. The data revealed that during Rabi season maximum leaf area (472.33 cm², 1473.20 cm², 3381.00 cm² and 4268.67 cm²) at 30, 60, 90 and 120 DAP respectively was observed with application of T₁₀ (Vermicompost 750 Kg/ha + Farmyard Manure 3.75 t/ha + Neem cake 375 Kg/ha) which were on par with T₆ (Neem Cake 1 t/ha) (469.93 cm², 1436.67 cm², 3260.87 cm² and 4132.73 cm²) followed by T₈ (Vermicompost 750 kg/ha + Neem Cake 375 kg/ha) (453.42 cm², 1264.83 cm², 3094.67 cm² and 4004.27 cm²) while it was minimum in T₁₁ (Control) (312.73 cm², 879.93 cm², 1222.33 cm² and 2022.73 cm²).

These results may be attributed to the effect of organic manures in increasing levels of endogenous hormones in treated plants which could be interpreted by cell division and cell elongation (Khedr and Farid, 2000) ^[11]. Further, this may be due to the physiological roles of vitamins and amino acids in the effect of organic treatments which increased role of the metabolic processes and levels of indigenous hormones, i.e., IAA and GA₃. The present investigated results were in accordance to those found by Jaya Sri and Anuja (2010) ^[10], Baraa *et al.*, (2017) ^[4] and Shareef *et al.*, (2019) ^[18] in *Ocimum* sps. Divya Bhargavi *et al.*, (2017) ^[8] and Chandana *et al.*, (2018) ^[6] in Kalmegh.

Yield parameters

Days taken for initiation of flowering

The data enunciated on the number of days for initiation of flowering as affected by the organic manures in pure form and in combinations. Among all the treatments, T₁₀ (Vermicompost 750 Kg/ha + Farm yard Manure 3.75 t/ha + Neem cake 375 Kg/ha) recorded minimum days taken for initiation of flowering (45.20 days) which was statistically on par with T₆ (Neem cake 1 t/ha) (45.62 days) and followed by T₈ (Vermicompost 750 Kg/ha + Neem cake 375 Kg/ha) (46.33 days), while more number of days taken for initiation of flowering (53.33 days) was recorded in T₁₁ (control). Early flowering in these treatments could be attributed to better vegetative growth due to the influence of bio-active growth

promoting substances like auxin and GA by vermicompost and Neem cake. Similar findings were reported by Mounika (2021) ^[13] in *Ambrette*, Umesha *et al.*, (2011) ^[22] in *Solanum nigrum*.

No. of inflorescences/plant

Number of inflorescences per plant was significantly influenced due to different organic manures. The highest number of inflorescence per plant was recorded in treatment T₁₀ (Vermicompost 750 Kg/ha + Farm yard Manure 3.75 t/ha + Neem cake 375 Kg/ha) (66.61) which was statistically on par with T₆ (Neem cake 1 t/ha) (65.99), followed by T₈ (Vermicompost 750 Kg/ha + Neem cake 375 Kg/ha) (63.47) while minimum number of inflorescence per plant (48.67) was recorded in T₁₁ (Control).

The maximum number of inflorescences per plant might be application of balanced nutrition through different organic manures which resulted in increased vegetative growth and synthesis of relatively more amount of food materials and photosynthates which were translocated and accumulated in the reproductive parts, led to pro fuse flowering per plant. The results are in line with Mounika (2021) ^[13] in *Ambrette*, Umesha *et al.*, (2011) ^[22] in *Solanum nigrum*.

Fresh yield per hectare (q)

With respect to different organic treatments, fresh yield per hectare was significantly affected at harvest. The treatment T₁₀ (Vermicompost 750 Kg/ ha + Farm yard Manure 3.75 t/ha + Neem cake 375 Kg/ha) recorded maximum fresh yield per hectare (132.15 q) which was statistically on par with T₆ (Neem cake 1t/ha) (130.05) and T₈ (Vermicompost 750 Kg/ ha + Neem cake 375 Kg/ha) (128.50), whereas treatment T₁₁ (Control) recorded minimum fresh yield per hectare (72.45 q). The increased fresh yield per hectare could be attributed to increased plant height, number of branches, plant spread, number of leaves, leaf area and dry matter accumulation with this treatment. Higher doses of organic manures not only supply major nutrients but also sufficient quantity of required micronutrients such as Zn, B, Fe, Cu, Mn etc. Organic manures, which are the rich sources of humus besides promoting higher N-fixation, P-solubilization which have

ability to mobilize the nutritionally important elements from non-usable to usable form through biological processes. It has been reported that the microbial population increased at tremendous rate as the organic matter decomposed in the soil with the subsequent release of nitrogen for the growth (Pavan

Yadav *et al.*, in 2006) [15]. The present investigation was in consistent with other reports of Kourosh *et al.*, (2011) [12], Raina *et al.*, (2013) [16], Hossain *et al.*, (2015) [9] in *Ocimum* sps.

Table 2: Effect of Vermicompost, Farmyard Manure and Neem Cake on Days taken for initiation of flowering, Number of inflorescences/plant, Fresh yield per hectare (q) and Seed yield per hectare (kg) in Sweet basil 2020-21

	Days taken for initiation of flowering	No. of inflorescences/plant	Fresh yield per hectare (q)	Seed yield per hectare (kg)
Treatments				
T ₁ = Vermicompost 1 t/ha.	49.66	57.33	96.75	360.00
T ₂ = Vermicompost 2 t/ha.	49.33	58.67	103.35	380.00
T ₃ = Farmyard Manure 5 t/ha.	51.05	54.96	86.70	320.00
T ₄ = Farmyard Manure 10 t/ha.	50.22	56.00	94.65	350.00
T ₅ = Neem Cake 500 kg/ha.	47.15	62.54	122.24	470.00
T ₆ = Neem Cake 1 t/ha.	45.62	65.99	130.05	600.00
T ₇ = Vermicompost 750 kg/ha + Farmyard Manure 3.75 t/ha.	48.33	60.58	106.95	405.00
T ₈ = Vermicompost 750 kg/ha + Neem Cake 375 kg/ha.	46.33	63.47	128.50	510.00
T ₉ = Farmyard Manure 3.75 t/ha + Neem Cake 375 kg/ha.	47.74	62.07	113.45	440.00
T ₁₀ = Vermicompost 750 kg/ha + Farmyard Manure 3.75 t/ha + Neem Cake 375 kg/ha.	45.20	66.61	132.15	630.00
T ₁₁ = Control.	53.33	48.67	72.45	235.00
	S.Em±	0.66	0.77	1.44
	CD at 5%	1.98	2.33	4.31

Seed yield per hectare (Kg)

Seed yield per hectare was significantly influenced due to different organic manures. Among the different organic manure treatments highest seed yield per hectare was recorded in T₁₀ (Vermicompost 750 Kg/ ha + Farm yard Manure 3.75 t/ha + Neem cake 375 Kg/ha) recorded maximum value (630.00 kg), followed by T₆ (Neem cake 1t/ha) (600.00 kg), T₈ (Vermicompost 750 Kg/ ha + Neem cake 375 Kg/ha) (510.00 kg), while T₁₁ (Control) recorded minimum value (235.00 kg) in Rabi season.

The increase in seed yield might be due to the fact that nutrients released from combined application of FYM, VC and NC would have resulted in the increased nutrient availability, ascribed to improvement in soil health and adequate supply of both macro and micro nutrients, which in turn enhanced the seed yield. Moreover, the combined application of organic manures might have supplied adequate amounts of nutrients, which favoured higher metabolic rate and auxin activities in the plant, resulting in better yield attributes and higher seed yield. Similar findings have been reported Anuja and Jayasri (2011) [2], Daneshian *et al.*, (2009) [9] in Sweet basil. Umesha *et al.*, (2011) [22] in *Solanum nigrum*.

Conclusion

From the studies on different organic manures and there combinations revealed that, the growth and yield of Sweet basil were influenced by different organic manures. The combined application of Farm Yard Manure, Vermicompost and Neem Cake has recorded the best results in terms of growth and yield parameters.

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