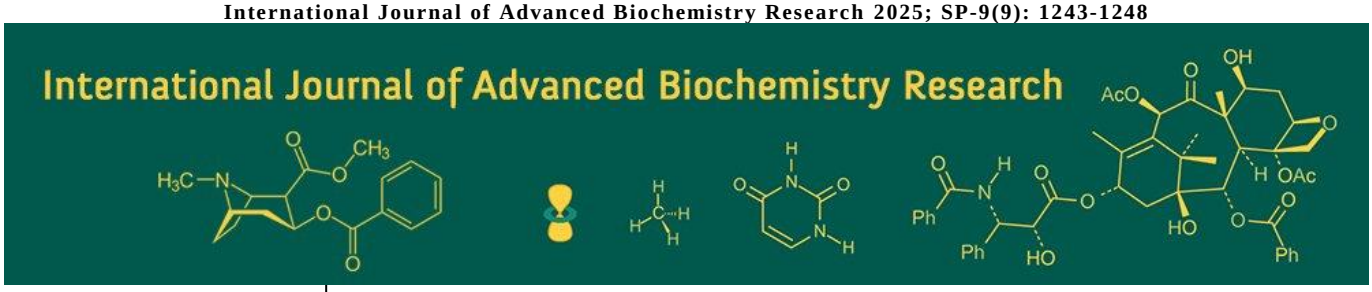


ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; SP-9(9): 1243-1248
www.biochemjournal.com
Received: 19-06-2025
Accepted: 22-07-2025

All authors' names and affiliations are given below, after the references.

Impact of organic and inorganic fertilizers on germination and growth of Basil (*Ocimum basilicum* L.).

Karuna Sidar, Bharti Sao, Anita Kerketta, Rekha Singh, Deepika Sahu, Ritu Sharma, Chumeshwari Sahu, Chandra Seni Chandra and Dankeshwar Jaiswal

DOI: https://www.doi.org/10.33545/26174693.2025.v9.i9Sp.5675

Abstract
A study was conducted to determine the Impact of organic and inorganic fertilizers on germination and growth of Basil (*Ocimum basilicum* L.). The investigation was conducted in the early summer of 2025 and involved 11 treatments that contained both inorganic fertilizers and organic manures, either in combination or alone, in a completely randomized design with three replicates. The results of this study demonstrated that both organic manures and inorganic fertilizers had a major effect on the germination, growth, and yield metrics of basil. The treatment that included 75% RDF and 25% vermicompost resulted in increased seed germination (16.96%), 50% seed germination (22.73%), germination % (91.83), survival % (89.55%), plant height (65.10 cm), number of branches (110.57), number of leaves (356.53), fresh herbage yield (282.06), and dry herbage yield (51.44), followed by 75% RDF and 25% poultry manure.

Keywords: Basil, organic manure, inorganic fertilizers, germination, growth, yield

Introduction
Ocimum basilicum L., also known as basil or French basil (2n=48), naturally contains tetraploids. For this genus, which mostly grows in France, Italy, Bulgaria, Egypt, Hungary, South America, and Comoro, the main sites of diversity are Africa, South America (Brazil), and Asia. India, Thailand, Haiti, Guatemala, and the islands. In India, basil is grown on 25,000 hectares, mostly in Uttar Pradesh, and yields between 250 and 300 tons of oil per year. The food, pharmaceutical, cosmetic, and fragrance industries use the essential oil extracted from aromatic leaves. The primary constituents of ocimum oil include methyl chavicol, citral, eugenol, geraniol, and linalool. Thymol and Methyl Cinnamate. It is used as a plant in traditional medicine because of its antifungal, antibacterial, and insecticidal properties. The leaves and inflorescences of basil are used as carminatives, galactagogues, stomachics, and antispasmodics in traditional medicine (Pragya *et al.*, 2016) [13].
According to Birkhofer *et al.* (2008) [2] and Enwall *et al.* (2005) [7], organic fertilizers have been shown to increase biodiversity and may act as a significant store of excess carbon dioxide (Lal, 2004) [10]. Although they release nutrients more slowly and have a lower nutritional value than chemical fertilizers, organic fertilizers are equally effective over longer periods (Naguib, 2011) [11]. Organic farming has proven to be productive and resource-conserving. Other good substitutes include vermicompost, FYM, and poultry manure. By utilizing a variety of locally accessible resources, primarily soil and faunal constituents that encourage synchrony in the nutrient cycle, these organic farming methods coexist peacefully with the ecosystem. The current study examined the effects of organic manure and inorganic fertilizer techniques on the growth and output of basil.

Material and methods
The present study was conducted at the College of Horticulture and Research Station, Sankara Patan Durg (C.G.), from February to June 2025, employing 11 treatments: T_0 (control using soil and sand), T_1 (100% recommended dose of fertilizers [RDF] through urea,

Corresponding Author:
Karuna Sidar
M.Sc. Scholar, Department of Plantation, Spices, Medicinal and Aromatic Crops, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

single superphosphate [SSP], and muriate of potash [MOP]), T_2 (100% vermicompost), T_3 (100% poultry manure), T_4 (100% farmyard manure [FYM]), T_5 (75% RDF + 25% vermicompost), T_6 (50% RDF + 50% vermicompost), T_7 (75% RDF + 25% poultry manure), T_8 (50% RDF + 50% poultry manure), T_9 (75% RDF + 25% FYM), and T_{10} (50% RDF + 50% FYM). The treatments were replicated thrice using a randomized complete block design. Organic manure and inorganic fertilizers were incorporated during the preparation of the media for individual polybags. The inorganic fertilizers were applied as follows: urea at 100% (9.3 g/polybag), 75% (6.97 g/polybag), and 50% (4.65 g/polybag); SSP at 100% (13.5 g/polybag), 75% (10.12 g/polybag), and 50% (6.75 g/polybag); and MOP at 100% (2.3 g/polybag), 75% (1.72 g/polybag), and 50% (1.15 g/polybag). The experiment with basil seeds was conducted in 2025 under nursery and polybag conditions. A completely randomized design (CRD) with 11 treatments (T_1-T_{11}), three replicates, and 10 polybags per treatment was employed, resulting in a total of 330 experimental units. Certified lemon basil seeds with high germination rates were used. Polybags measuring 11 × 12 inches were used, perforated at the base for drainage, and labeled according to the treatment. A uniform potting medium was prepared and filled into bags prior to sowing. Initially, weeding was performed manually, and irrigation was applied every 3-4 days. Subsequently, the irrigation was adjusted based on the soil moisture content. In the final week of June, the crop was harvested at ground level. The weight of fresh herbage in each polybag was converted to grams (g) per polybag. The data were evaluated using ANOVA (Panse, 1985) [12]. Statistical significance was tested using the "F" value at the 5% level of significance.

Result and Discussion

Germination parameter

Basil germination parameters varied greatly because of the application of varying amounts of organic and inorganic fertilizers (Table 1).

Seed germination

Seed germination is profoundly influenced by various nutrient-management strategies. The control group exhibited the lowest seed germination rate (20.33), whereas the highest germination rate (16.63), which was statistically superior to other treatments, was achieved with the application of 75% RDF combined with 25% vermicompost. Treatments employing integrated nutrient management (INM), particularly those incorporating both chemical fertilizers and vermicompost, consistently demonstrated superior germination compared to the use of RDF, FYM, poultry manure, or vermicompost in isolation. The enhanced germination observed under the 75% RDF + 25% vermicompost treatment may be attributed to the synergistic effects of readily available nutrients from RDF and the soil-enhancing properties of vermicompost, which augment microbial activity, moisture retention and enzymatic stimulation. Additionally, vermicompost provides plant growth regulators such as gibberellins, cytokinins, and auxins, which facilitate germination. Conversely, the reduced germination in the control group may be ascribed to inadequate soil fertility and deficiency of organic matter.

50% seed germination

Statistical analysis of 50% seed germination revealed significant differences among the treatments. The treatment comprising 75% RDF and 25% vermicompost resulted in the longest duration for 50% germination (22.73 d) compared to all other treatments. This was closely followed by treatment with 75% RDF and 25% poultry manure (23.00 days). Notably, the control group exhibited the shortest duration (34.23 days), which was shorter than any of the integrated nutrition treatments. This suggests that the combined application of organic and inorganic fertilizers enhances germination performance more effectively than either a single application or an unfertilized control. A balanced nutrient supply from RDF provides rapid nutrient availability, whereas vermicompost offers slow-release nutrients, organic carbon, and growth regulators that promote enzymatic activity and moisture retention, thereby improving germination with RDF and vermicompost. Similar benefits of integrated nutrient management have been documented for fenugreek (Choudhary *et al*., 2011) [4], tulsi, mint (Rahman *et al*., 2014) [14] and basil (Singh *et al*., 2013) [15]. Poor fertility and nutritional deficiencies resulted in lower germination rates in the control group. Therefore, for early and consistent basil germination, a combination of 75% RDF and 25% poultry manure was the most effective combination.

Germination%

The germination rate was highest (91.83%) in the treatment comprising 75% RDF and 25% vermicompost, while the lowest rate (81.86%) was observed in the control. The 75% RDF + 25% vermicompost treatment significantly enhanced the germination percentage compared to the other treatments, whereas the control group exhibited the poorest performance due to inadequate nutrition (Geetha and Shanmugapriya (2020)) [8]. The superior germination observed under the 75% RDF + 25% vermicompost treatment may be attributed to a balanced nutrient supply, wherein RDF provided readily available nutrients essential for early seed metabolic activity and vermicompost improved soil structure, aeration, and moisture retention. Additionally, vermicompost enhances seed emergence by increasing microbial activity and nutrient-mineralization. Similar beneficial effects of organic amendments on basil germination have been demonstrated by Shahzaman *et al*. (2017) [16].

Survival%

The maximum survival rate was 90.29% for the treatment comprising 75% RDF and 25% vermicompost, whereas the lowest survival rate was 79.33% for the control treatment. The superior survival rate associated with the 75% RDF + 25% vermicompost treatment can be attributed to the consistent and well-balanced nutritional supply. RDF facilitates the rapid availability of essential nutrients, thereby aiding seedlings in establishing themselves and withstanding environmental stresses. Concurrently, vermicompost enhances soil structure, porosity, and moisture-retention capacity. Organic manures are also recognized for augmenting soil microbial activity and nutrient mineralization, promoting root growth and increasing survival rates. Similar observations have been reported by Singh *et al*. (2013) [15] for basil and Choudhary *et al*. (2011) [4] for fenugreek, where organic amendments improved seedling establishment and survival rates. The low

survival rate in the control treatment (79.33%) may be attributed to low organic matter, reduced soil fertility, and limited nutrient availability, which weaken the plants and inhibit root growth, rendering them more susceptible to death.

Growth parameter

Basil growth parameters varied greatly because of the application of varying amounts of organic and inorganic fertilizers (Table 2).

Plant height

The treatment comprising 75% RDF and 25% vermicompost resulted in the greatest plant height (65.10 cm), whereas the control treatment yielded the lowest height (47.43 cm). The most effective treatment for enhancing plant height was 75% RDF combined with 25% poultry manure, whereas the control treatment exhibited minimal growth because of inadequate nutrient availability. The superior plant height observed with the 75% RDF and 25% vermicompost treatment can be attributed to the synergy between the readily available nutrients from RDF and the soil-enhancing properties of vermicompost. Vermicompost contributes to increased plant height by improving soil porosity, aeration, microbial activity, and moisture retention, thereby creating a conducive rhizosphere environment for enhanced root growth and nutrient uptake in plants. Similar enhancements in plant height with organic amendments have been reported by Choudhary *et al*. (2011) [4] for fenugreek and Singh *et al*. (2013) [15] for basil, respectively. Rahman *et al*. (2014) [14] noted that organic manure enhanced the growth characteristics of tulsi and mint by augmenting soil fertility. Conversely, the control group exhibited the lowest plant height (47.43 cm) due to restricted growth caused by low soil fertility and nutrient deficiencies, which impeded root development and nutrient absorption.

Number of branches

The treatment comprising 75% RDF and 25% vermicompost resulted in the highest number of branches (110.57), in contrast to the control treatment, which exhibited the lowest number of branches (40.63). The 75% RDF + 25% vermicompost treatment was the most effective in enhancing branch proliferation, whereas the control yielded the least favorable outcomes. The increased number of branches observed in the 75% RDF + 25% vermicompost treatment can be attributed to the synergistic effects of vermicompost, which enhances soil properties such as microbial activity, porosity, aeration, and moisture retention, along with the rapid nutrient availability provided by RDF. These factors collectively promote robust vegetative growth, improved root development, and efficient nutrient uptake, ultimately leading to increased branch growth. Similar findings were reported by Singh *et al*. (2013) [15].

Number of Leaves

The treatment combining 75% RDF with 25% vermicompost yielded the highest value at 356.53, whereas the control treatment recorded the lowest value at 203.13. At 120 DAS, the 75% RDF + 25% vermicompost treatment was the most effective for enhancing plant growth, whereas the control treatment lagged due to nutritional limitations. The plant height, number of nodes, and count of primary and secondary branches stemming from the main stem all influence leaf production. Plants with more branches tend to produce more leaves. These results align with the findings of Ihenacho *et al*. (2015) [9] on turmeric, Rahman *et al*. (2014) [14] on tulsi and pudina, and Chamroy *et al*. (2015) [3] on chili.

Yield parameters

Fresh herbage yield/plant

The treatment comprising 75% RDF and 25% vermicompost yielded the highest value (282.06), in contrast to the control treatment, which yielded the lowest value (102.53). The 75% RDF + 25% vermicompost treatment was the most effective in optimizing plant growth, whereas the control treatment was the least effective because of insufficient nutrient availability in the soil. The synergistic application of organic manure and inorganic fertilizers likely enhanced the fresh weight of herbage by augmenting the auxin content, nitrogen metabolism, and photosynthetic activity of the plants. This, in turn, led to increased plant height, a greater number of primary branches, an increased number of leaves, and an expanded leaf area per plant. These growth parameters were positively correlated with fresh herb yield and contributed to an overall increase in plant biomass. These findings are consistent with those reported by Rahman *et al*. (2014) [14] for tulsi, Ahmad *et al*. (2011) [1] for marjoram, and Singh (2013) [15] for lemongrass.

Table 1: Effect of organic and inorganic fertilizers on germination parameter of Basil (*Ocimum basilicum*)

	Germination parameter			
Treatment	**Days taken to seed germination**	**Days taken to 50% Germination**	**Germination percentage**	**Survival percentage**
T_0	20.33	34.23	81.86	79.33
T_1	18.72	30.17	86.44	84.73
T_2	18.89	30.97	85.37	83.89
T_3	18.12	32.90	85.30	83.24
T_4	18.00	33.07	82.97	81.99
T_5	16.63	22.73	91.83	90.29
T_6	17.00	25.07	89.43	87.13
T_7	16.96	23.00	90.72	88.61
T_8	17.63	27.00	88.14	86.87
T_9	17.85	25.70	88.66	87.22
T_{10}	17.92	28.60	87.04	85.07
S. Em±	0.773	0.485	1.088	0.573

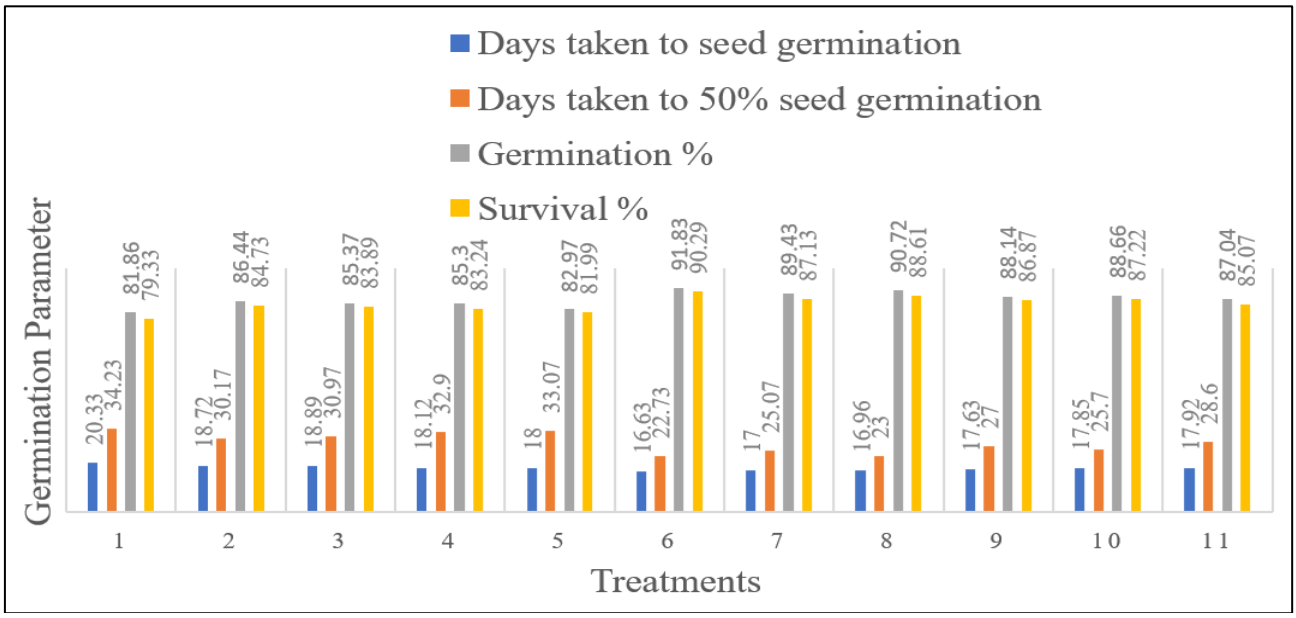
C D @ 0.05	2.267	1.422	3.190	1.681

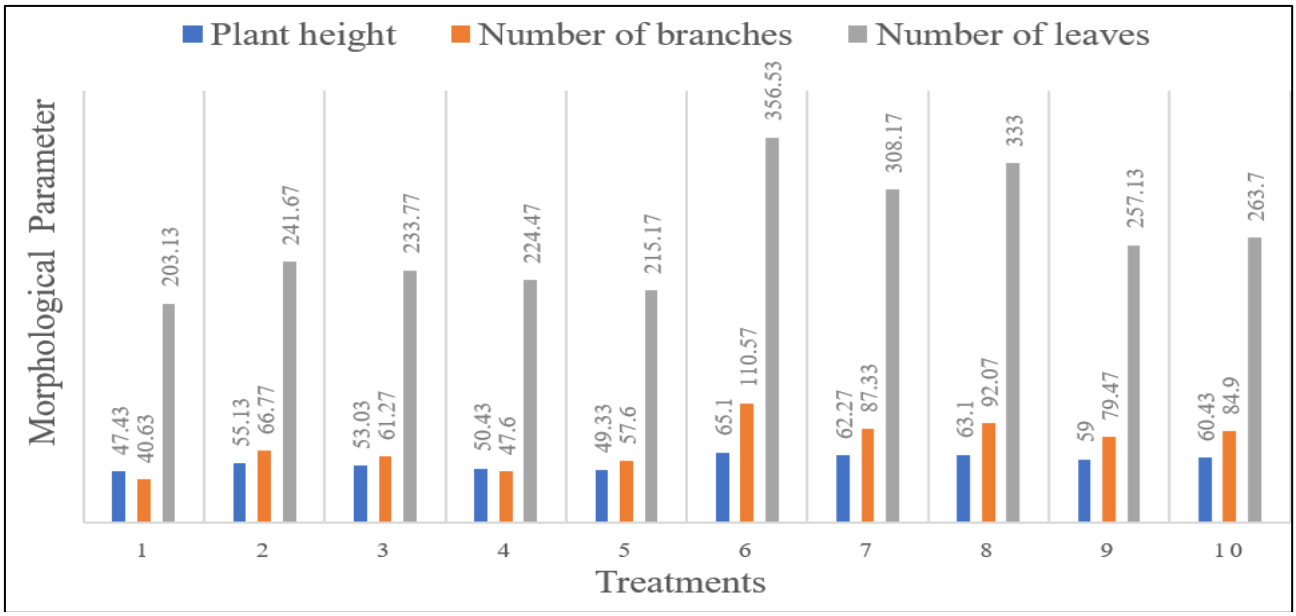
Table 2: Effect of organic and inorganic fertilizers on morphological parameter of Basil (*Ocimum basilicum*)

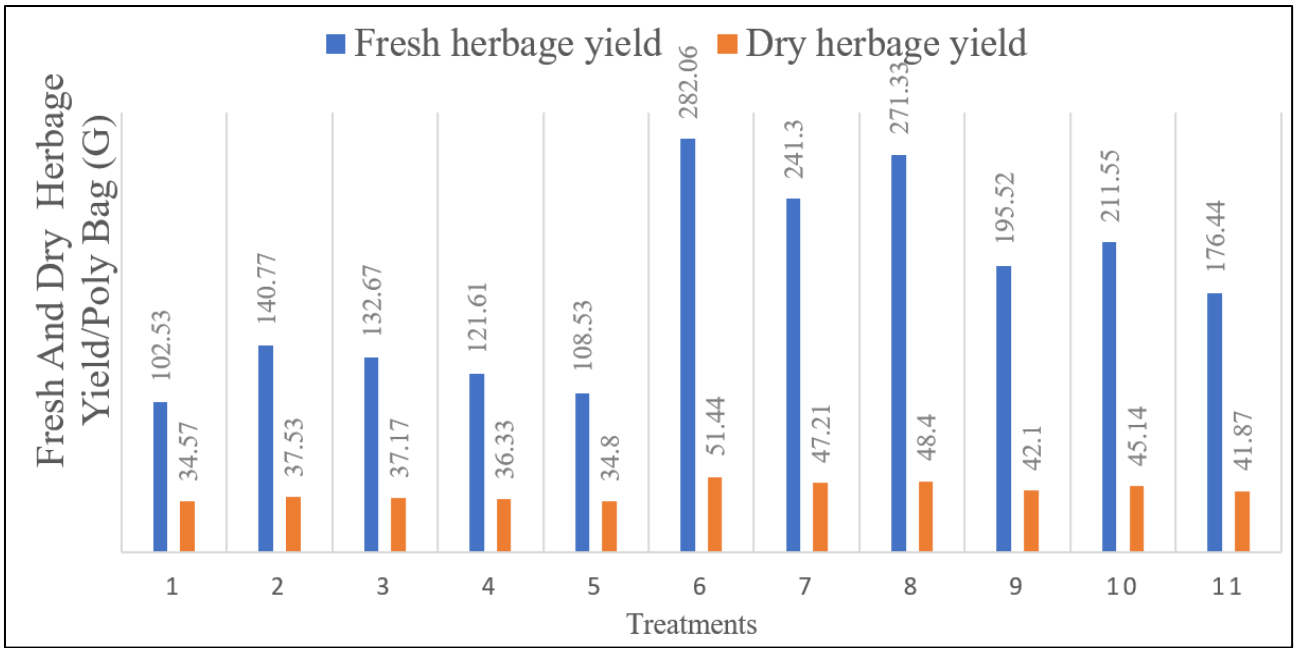
Morphological parameter			
Treatment	**Plant height**	**Number of branches**	**Number of leaves**
T_0	47.43	40.63	203.13
T_1	55.13	66.77	241.67
T_2	53.03	61.27	233.77
T_3	50.43	47.60	224.47
T_4	49.33	57.60	215.17
T_5	65.10	110.57	356.53
T_6	62.27	87.33	308.17
T_7	63.10	92.07	333.00
T_8	59.00	79.47	257.13
T_9	60.43	84.90	263.70
T_{10}	57.97	71.03	245.77
S. Em±	0.791	1.348	3.770
C D @ 0.05	2.320	3.954	11.057

Table 3: Effect of organic and inorganic fertilizers on yield parameter of Basil (*Ocimum basilicum*)

Yield parameter		
Treatment	**Fresh herbage yield/plant (g)**	**Dry herbage yield/plant (g)**
T_0	102.53	34.57
T_1	140.77	37.53
T_2	132.67	37.17
T_3	121.61	36.33
T_4	108.53	34.80
T_5	282.06	51.44
T_6	241.30	47.21
T_7	271.33	48.40
T_8	195.52	42.10
T_9	211.55	45.14
T_{10}	176.44	41.87
S. Em±	1.355	0.546
C D @ 0.05	3.973	1.601







Dry herbage yield

The treatment comprising 75% RDF and 25% vermicompost yielded the highest value (51.44), whereas the control treatment yielded the lowest value (34.57). For optimal growth, the combination of 75% RDF and 25% vermicompost proved to be the most effective, while the control treatment was the least effective owing to nutrient deficiencies. The integration of inorganic nutrient sources with organic manures was employed to ensure the immediate availability of nutrients for the initial plant requirements. Inorganic sources were utilized gradually, with organic manures providing sustained nutrient availability in the long term. Studies by Elza *et al*. (2014) [6] on *Achillea millefolium*, El-Sayed *et al*. (2018) [5] on Citronella, and Choudhary *et al*. (2011) [4] on Fenugreek have reported increased dry weights per plant and per hectare, attributed to the consistent availability of nutrients, which facilitated enhanced nutrient uptake and greater dry matter accumulation throughout all growth stages.

Conclusion

The present investigation revealed that among the different combinations of organic manures and inorganic fertilizers, significantly higher seed germination (50%), germination%, survival%, plant height, number of branches, number of leaves, fresh herbage yield per plant, and dry herbage yield per plant were obtained with the application of 75% RDF and 25% vermicompost. Hence, the incorporation of 75% RDF and 25% poultry manure may be recommended for basil crops to acquire higher germination, growth, and herbage.

Acknowledgement

Authors are thankful to Department of Floriculture and Landscaping, MGUVV, Durg (C.G.) 491111, for providing the financial assistance and facilities.

Disclaimer (Artificial Intelligence)

Authors hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

Competing Interests

Authors have declared that no competing interests exist.

References

1. Ahmad H, Al-Fraihat S, Sati YA, Al-Dalain ZB, AlRawashdeh, *et al*. Effect of organic and biofertilizers on growth, herb yield, and volatile oil of marjoram plant grown in Ajloun region, Jordan. J Med Plant Res. 2011;5(13):2822-2833.
2. Birkhofer K, Bezemer TM, Bloem J, Bonkowski M, Christensen S, Dubois D, *et al*. Long-term organic farming fosters below and aboveground biota: implications for soil quality, biological control and productivity. Soil Biol Biochem. 2008;40(9):2297-2308.
3. Chamroy T, Rajwade VB, Bajad VV. Effect of organic and inorganic manorial combinations on turmeric (*Curcuma longa* L.). Plant Arch. 2015;15(1):67-69.
4. Choudhary BR, Gupta AK, Parihar CM, Jat SL, Singh DK. Effect of integrated nutrient management on fenugreek (*Trigonella foenum-graecum*) and its residual effect on fodder pearl millet (*Pennisetum glaucum*). Indian J Agron. 2011;56(3):189-195.
5. El-Sayed AA, El-Leithy AS, Swaefy HM, Senossi ZFM. Effect of NPK, bio and organic fertilizers on growth, herb yield, oil production and anatomical structure of *Cymbopogon citratus* (Stapf). Annu Res Rev Biol. 2018;26(2):1-15.
6. Elza OF, Suzan KVB, Jose EBPP, Andreisa FB, Andressa GC. Organic systems in the growth and essential-oil production of the yarrow. Rev Cienc Agron. 2014;45(1):111-119.
7. Enwall K, Laurent P, Sara H. Activity and composition of the denitrifying bacterial community respond differently to long-term fertilization. Appl Environ Microbiol. 2005;71(2):8335-8343.
8. Geetha S, Karpagam T, Varalakshmi B, Shanmugapriya A. Effect of organic fertilizers on seed germination and seedling vigour of fenugreek. Phys Chem Biol Sci: Emerg Trends Milestones. 2020; p.12-20.
9. Ihenacho LU, Okorie HA, Christo IE, Peter OCA. Effect of poultry manure rates on the growth and yield

of turmeric (*Curcuma longa* L.) in Nigeria. J Agric Vet Sci. 2015;8(1):34-38.
10. Lal R. Soil carbon sequestration impacts on global climate change and food security. Science. 2004;304:1623-1627.
11. Naguib NYM. Organic vs chemical fertilization of medicinal plants: a concise review of research. Adv Environ Biol. 2011;5(2):394-400.
12. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. New Delhi: ICAR; 1985.
13. Pragya S, Gyanendra T, Mehta SC. Nitrogen and sulphur application affect phenology and essential oil productivity of French basil (*Ocimum basilicum*). Int J Agric Sci. 2016;8(35):1729-1732.
14. Rahman KM, Sattar MA, Rahman GMM. Effect of fertilizer and manures on growth and yield of *Ocimum sanctum* (tulsi) and *Mentha arvensis* (pudina). J Environ Sci Nat Resour. 2014;7(2):13-16.
15. Shahi VB, Singh PN. Effect of organic and inorganic sources of nutrients on yield and yield attributes of lemongrass (*Cymbopogon flexuosus*). Ann Hortic. 2013;6(1):49-55.
16. Shahzaman M, Ishtiaq M, Azam A. Effect of different fertilizers on seed germination and seedling growth of sunflower (*Helianthus annuus* L.) from district Bhimber of Azad Jammu and Kashmir, Pakistan. Int J Bot Stud. 2017;2(2):10-15.
17. Veena SK, Giraddi RS, Bhemmanna M, Kandpal K. Effect of neem cake and vermicompost on growth and yield parameter of chilli. J Entomol Zool Stud. 2017;5(5):1042-1044.

Authors Details

Karuna Sidar
M.Sc. Scholar, Department of Plantation, Spices, Medicinal and Aromatic Crops, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

Bharti Sao
Assistant Professor, Department of Floriculture and Landscaping, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

Anita Kerketta
Assistant Professor, Department of Vegetable Science, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

Rekha Singh
Associate Professor, Department of Extension, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh

Deepika Sahu
Ph.D., Scholar, Department of Floriculture and Landscaping, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

Ritu Sharma
M.Sc. Scholar, Department of Plantation, Spices, Medicinal and Aromatic Crops, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh

Chumeshwari Sahu
M.Sc. Scholar, Department of Plantation, Spices, Medicinal and Aromatic Crops, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh

Chandra Seni Chandra
M.Sc. Scholar, Department of Vegetable Science, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

Dankeshwar Jaiswal
M.Sc. Scholar, Department of Vegetable Science, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India