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The Growth and Fresh Herbage Yield of Coriander (*Coriandrum sativum* L.) as Influenced by Organic and Inorganic Fertilisers

Omveer SINGH[1], LP YADAVA[2*], Jashkaran SINGH[3]

[1-3]Department of Horticulture, CBG Agriculture PG College, Lucknow-226201 (UP), INDIA

[1]https://orcid.org/0009-0008-2262-3870, [2]https://orcid.org/0000-0002-1687-0567, [3]https://orcid.org/0009-0008-1736-9011

*Corresponding Author: drlpy.spa@gmail.com

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ABSTRACT

The coriander leaves are very popular green spiece in India. But little attention has been paid to opptimise proper manuring through organic sources for its profitable cultivation. Adequate supply of fertilizer to the coriander plant is first urgent need for short duration crop. To examine the best combination an experiment was conducted at Vegetable Research Farm, Department of Horticulture, Chandra Bhanu Gupta Agriculture PG College, Lucknow (U.P.) during the *Rabi* season of 2023-24, consisting seven treatments including T_1: control, T_2: 100% RDF (60:40:30 kg NPK/ha), T_3: Vermicompost @3 t/ha, T_4: FYM @10 t/ha, T_5: 50% RDF (30:20:15 kg NPK/ha) + Vermicompost @1.5 t/ha, T_6: 50% RDF (30:20:15 kg NPK/ha) + FYM @5 t/ha and T_7: Vermicompost @1.5 t/ha + FYM @5 t/ha. Treatments were plotted in Randomized Block Design with three replication. The highest growth, yield attributes and yield were significantly observed in the treatment of T_7 (Vermicompost @ 1.5 t/ha + FYM @5 t/ha) *viz.*, plant height (24.27cm), number of primary branches/plant (5.80), number of secondary branches/ plant (10.15), fresh weight (6.92 g) and fresh herbage yield per hectare (6463.33kg) was obtained in coriander at 45 days after sowing. Thus, it may be concluded that highest production of green leaves can be achieved by application of Vermicompost @ 1.5 t/ha + FYM @5 t/ha.

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INTRODUCTION

Coriander (*Coriandrum sativum* L.), member of the Apiaceae family with a chromosome number of 2n = 22, is a popular spice crop grown throughout India and commonly referred to as Dhania. It is little bushy, erect annual herb having 20-60 cm height with several branches and umbels. Leaves are alternate and compound. Lower leaves are broad with crenately lobate margins and upper leaves are finely cut with linearly lobes. The whole plant has a pleasing aroma. Coriander Flowers are small, white or pink with terminal compound umbels. The inflorescence consists of a compound umbel made up of five smaller umbels. The fruit is schizocarp, roughly spherical, measuring three to four millimetres in diameter, and when pressed, splits into two locules, each containing a single seed. The Fruit has a delicate fragrance, its seeds range in colour from pale white to light brown (Bhuyian et al., 2009). The classification consists of two distinct categories: leafy and seed-bearing varieties. The leaves of coriander are a good source of vitamin C, vitamin K and

protein. Steam distillation yields essential oils in amounts ranging from 0.2 to 1.2 percent in coriander seeds. The main constituents of coriander essential oil include linalool at 67.7%, followed by 1-pinene at 10.5 percent and 1-terpinin at 9.0 percent, as well as geranyl acetate at 4.0 percent and geraniolol at 1.9 percent. Additionally, its minor components comprise 1-pinene along with other compounds such as camphene, myrcene, dipentene, 1-terpinene, limonene, p-cymol, n-decylaldehyde, beornol and acetic acid esters (Shahwar et al., 2012). Larger seeds tend to have less intense aromas and lower oil content compared to their smaller counterparts. Tender shoots and leaves are often used in chutney, soups, and salads because of their pleasant fragrance. Other than a condiment, coriander additionally has therapeutic qualities.

India produced large amount of coriander in the world. It is mainly cultivated in M.P., Gujarat, Rajasthan, Andhra Pradesh, Odisha, Assam and Tamil Nadu. In India total area under coriander cultivation is 6,27,000 ha. with the production of 8,69,440 metric tonnes. In context of Uttar Pradesh, total area under spices cultivation is 4,29,790 ha. With the production of 3,11,780 metric tonnes. In which 7,450 ha. area is account for coriander with 4,810 metric tonnes of production (Anonymous, 2025).

The area under the crop cultivation is increasing because of its high monetary value. However, the yield per unit area is still low because of the use of traditional varieties and insufficient use of manures and fertilizers. Plant growth and seed yield are mainly affected by the nutrient fertility level of the soil, in addition to the genetic potential of the plant variety. Enhancing soil nutrient levels and fertility by applying a well-balanced and sufficient amount of key nutrients, including nitrogen, phosphorus, and potassium, in accordance with crop requirements is a straightforward method to increase coriander productivity. The long-term viability of traditional farming practices is being called into question due to heavy dependence on non-renewable energy sources, rising costs of fertilisers, soil health decline, excessive use of agricultural chemicals, and the impact of chemical residues on the food chain and soil microbiota. The sustainable approach focuses on integrated nutrient management, which aims to decrease the reliance on chemical fertilizers through the incorporation of organic alternatives. The core principle of integrated nutrient management system INM involves preserving soil fertility, supporting agricultural productivity, and increasing farmers' profitability by utilising chemical fertilizers and organic manures in a prudent and efficient manner. Fertilizers derived from a single source, including chemical fertilizers, organic manures, and crop residues, cannot provide the optimal and continuously high levels of crop yields.

Research has shown that the use of macro-nutrients (NPKS) apparently led to a significant increase in coriander seed yields (Kamrozzaman et al., 2016). Of the various major plant nutrients, plants need vast amounts of nitrogen because it is a component of macromolecules such as protein, which facilitates cell elongation and promotes

vegetative growth. In its early stages of growth, coriander primarily absorbs phosphorus, resulting in a higher herbage yield. Potassium is necessary for the development of chlorophyll, a vital component that plays a crucial role in cell strength.

Farmyard manure FYM is derived from plant and animal residue sources, that's why, it supplies the whole plant nutrients in easily available form to the soil and finally absorbed by the plants. It has a remarkable positive effect on the physical, chemical, and biological characteristics of the soil. Farmyard manure enhances soil ability to retain water as well as improves aeration in dense soils. This resource is readily available locally and can be effectively employed for vegetable cultivation. It is bulky and contains a small amount of nutrients, which means it is applied in large quantities; however, FYM also provides essential trace or micro nutrients that cannot be replaced by other sources. Consequently, it is necessary to establish the ideal fertilizer mix of FYM, vermicompost, and inorganic sources for crops, ensuring that the entire nutrient requirement of the crop is satisfied throughout its growth period, ultimately leading to a better yield.

MATERIAL and METHOD

An experiment was conducted at Vegetable Research Farm, Department of Horticulture, Chandra Bhanu Gupta Agriculture PG College, BKT, Lucknow 226201 (UP) during the Rabi season 2023-24. The field is located at 26°84′ N latitude, 80°94′ E longitude with an altitude of 123 m above mean sea level. The soil of the experimental area belongs to alluvial loam in texture and pH of the soil is 7.4. The experiment was laid out in Randomized Block Design with three replications. There were seven treatments consisting T_1: control, T_2: 100% RDF (60:40:30 kg NPK/ha), T_3: Vermicompost @3 t/ha, T_4: FYM @10t/ha, T_5: 50% RDF (30:20:15kg NPK/ha) + Vermicompost @1.5 t/ha, T_6: 50% RDF (30:20:15 kg NPK/ha) + FYM @5 t/ha and T_7: Vermicompost @ 1.5 t/ha + FYM @ 5 t/ha.The seeds of coriander were split into halves, soaked in water overnight and treated with *Trychoderma viride* before sowing. The seeds were sown on dated 20 October, 2023 at a spacing of 15 x 10 cm in flat bed under all the fixed environmental conditions. The cultivation practices were followed as per the recommended crop production guide for Uttar Pradesh.

Five sampl plants from each replication were tagged randomly to record data on growth and fresh herbage yield. The fresh herbage yield of coriander leaves were observed after 45days of sowing.

RESULTS and DISCUSSION

Effect of Organic and Inorganic Fertilizers on Vegetative Growth

Growth parameters in terms of plant height (cm), number of primary branches, number of secondary branches, length and width of leaf (cm) at various stages varied

due to application of various treatments of organic and inorganic fertilizers (Table 1). The application of 1.5 tonnes per hectare of Vermicompost in combination with 5 tonnes per hectare of Farm Yard Manure (T_7) had a significant impact on plant height at different growth stages, resulting in taller plants with a recorded height of 24.27 cm. The lowest plant height measured was 18.04 cm in the T_1 treatment (Table 1) i.e. control.

The number of primary and secondary branches displayed comparable trends and was clearly differed by the T_7 treatment. A higher branching (5.80) was found in the T_7 treatment, in contrast to the lowest number of primary branches, which was 3.49, observed in the T_1 treatment (Table 1). The most secondary branches (10.15) were found in the T_7 treatment, whereas the least (7.03) were noted in the T_1 treatment (Table 1). The increased plant height and the number of primary and secondary branches resulting from T_7 treatment may be attributed to the combined use of organic fertilizers (Vermicompost and FYM), which led to accelerated cell division, multiplication, and elongation in the plant's meristematic region due to the production of plant growth substances and growth-promoting compounds by FYM and Vermicompost applications. This stimulated the plant's metabolic process, including enhanced nutrient uptake from insoluble forms like phosphorus, which was converted into a more soluble form, through the activation of beneficial enzymes. More secondary branches per plant were produced as a result of increased plant height, which resulted in more photosynthetic activity, which led to the secondary development of more branches per plant. Compost improves the moisture level, aeration and temperature of the soil and therefore facilitate plant growth, which in turn increases plant height (Agrawal et al., 2003). The application of farm yard manure and Vermicompost boost the activities of beneficial soil microorganism and improves the supply of mineral nutrients, soil structure, water retention capability and enzymatic activities. The present findings were in conformity with the findings of Moslemi et al. (2012), Godara et al. (2014), Dadiga et al. (2015) and Nisarata et al. (2020).

Effect on Herbage Yield and Yield Attributes

Yield attributes in terms of total fresh weight of plant (g/plant), total dry weight of plant (g/plant), total herbage yield per plot (g) and total herbage yield per hectare (kg) varied due to application of various treatments of organic and inorganic fertilizers (Table 1).

The combination of 1.5t ha^{-1} Vermicompost + 5t ha^{-1} FYM per hectare (T_7) has a considerable impact on total plant fresh and dry weight, measured in grams per plant. The highest plant fresh weight of 6.92 g was noted in treatment T_7, while the lowest fresh weight of 5.03 g was recorded in treatment T_1, which served as the absolute control. In treatment T_7, the highest dry weight of 2.12 g was recorded, while treatment T_1 yielded the lowest dry weight of 1.53 g, as shown in Table 1. Of all the

treatments tested, treatment T_7, which involved the use of 1.5t ha^{-1} Vermicompost and 5 tonnes per hectare of FYM, produced the highest herbage yields per plot (3231.67 g/plot) and per hectare (6463.33 kg/ha). Treatment T_1, which featured absolute control, yielded the lowest results in terms of herbage per plot (668.67 g/plot) and per hectare (1337.33 kg/ha), as presented in Table 1.

Table 1. Effect of organic and inorganic fertilizers on plant height (cm), No. of primary and secondary branches fresh and dry weight of Coriander cv. Sonalika

Treatments	Plant height (cm)	Number of primary branches per plant	Number of secondary branches per plant	Plant fresh weight (g)	Plant dry weight (g)	Fresh herbage yield(kg/ha)
T_1	18.04	3.49	7.03	5.03	1.53	1337.33
T_2	20.01	4.17	8.11	5.81	1.89	3480.67
T_3	19.57	4.01	7.73	5.69	1.82	2740.00
T_4	18.96	3.69	7.45	5.13	1.72	1671.67
T_5	22.04	5.07	9.55	6.84	2.05	5544.67
T_6	20.52	4.57	8.75	6.34	1.96	4489.00
T_7	24.27	5.80	10.15	6.92	2.12	6463.33
SE(m)±	0.14	0.05	0.04	0.01	0.01	226.13
C.D. (P=0.05)	0.43	0.16	0.19	0.03	0.02	704.48

T_1: control, T_2: 100% RDF (60:40:30 kg NPK/ha), T_3: Vermicompost @3 t /ha, T_4: FYM @10 t/ha, T_5: 50% RDF (30:20:15 kg NPK/ha) + Vermicompost @1.5 t/ha, T_6: 50% RDF (30:20:15 kg NPK/ha) + FYM @5 t/ha and T_7: Vermicompost @ 1.5 t/ha + FYM @5 t/ha

The data clearly indicate that the yield of herbage rises with the use of organic manure, specifically Vermicompost and FYM. A balanced supply of nutrients is crucial for numerous metabolic processes, leading to enhanced plant growth and development, ultimately resulting in increased yields. Improvements in these processes could be achieved with the use of readily available nitrogen from organic fertilizers, ultimately leading to increased leaf yields. The cause may be attributed to the substantial effects on physical, chemical and biological soil properties. Vermicompost is particularly high in nutrients, notably nitrogen, which is gradually released so that plants can access them. Key nutrients in vermicompost, including nitrogen (N), phosphorus (P), and potassium (K), play crucial roles in plant life activities. The substance also includes micronutrients like iron, copper, zinc, and manganese. The results of this study are consistent with those of Patel et al. (2000) in fennel, Diovisalvi et al. (2016) in sunflower, Singh (2011), and Moslemi et al. (2012) in coriander. Karangwa et al. (2023) found that the combined use of organic and inorganic fertilizers has a greater synergistic effect on potato yield than their separate application, and warrants particular consideration to boost potato yield.

Effect on Quality Parameters

Quality parameters in terms of Total Soluble Solids (T.S.S.) (ºBrix) varied due to application of various treatments of organic and inorganic fertilizers and it is shown in Table 1.

The application of Vermicompost @1.5t/ha + FYM @5t/ha (T_7) showed maximum T.S.S. content (5.44 ºBrix), while the minimum T.S.S. content (4.19 ºBrix) was observed in treatment T_1 which is absolute control. The variability in T.S.S. content reading was substantial when different organic nutrient sources were used singularly or in conjunction with one another. The coriander leaf's moisture content improves progressively when organic components are used, possibly because of increased growth parameters, leading to better nutrient uptake and photosynthesis, ultimately enhancing the coriander's quality through enzymatic activities triggered by plant growth compounds. Earlier findings by Salem and Awad (2005), Singh (2011) and Moslemi et al. (2012) have yielded comparable outcomes. In contrast to these results, Ahmad et al. (2017) found that organic fertilizers have no substantial impact on T.S.S. in coriander leaves.

CONCLUSION and RECOMMENDATIONS

Based on the results of the study, the Vermicompost @ 1.5 t/ha + FYM @ 5 t/ha) was found to be superior in respect of growth, yield and quality of coriander. For the determination of an appropriate ratio of organic fertilizer experiment may be repeated at different locations for proper analysis. Further, the experimental results also provided the scope of treatment T_7: Vermicompost @ 1.5 t/ha + FYM @5 t/ha in the long run under organic farming of coriander for green leaves.

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Conflict of Interest Statement

The authors have declared that that there are no competing interests.

Authors Contribution

LP Yadava and Jashkaran Singh contributed to the project idea, design and execution of the study. Omveer Singh conducted the laboratory analyses. LP Yadava and Jashkaran Singh supervised the experiment and wrote the manuscript.

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