# Performance of coriander under organic and chemical nutrient management practice

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## Summary

Coriander is one of the most important spices and fresh-leaf vegetables, which is used widely across the globe. Organic cultivation of this crop has wide scope as it is short-duration and reduces the wastage of fertilizers as well as qualitative production. A field experiment was conducted at the School of Agricultural Sciences and Forestry, RTU Bangalore to know the effective application rate of compost for economic production compared to chemical fertilizer. The research data reveals that applying compost at 10t/ha produced significantly superior growth, yield parameters and herbage yield compared to the control. But it was on par with RDF treatment. Thus, applying compost at 10t/ha might be an effective nutritional input in the organic cultivation of coriander.

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## INTRODUCTION

Agricultural activities produce an enormous quantity of waste after the harvest of an economical part as well as the processing stage. These waste materials contain large reserves of nutrients, enzymes, and plant growth hormones which can support plant growth if used as initial input for cultivation. These waste materials are either in the form of green or dry refuges, slurries, solids, and peels. The cost of collection, transportation, and processing of this agricultural waste is low. It can be easily turned into a usable form by adopting effective recycling methodologies. Composting is the best low-cost method of recycling agricultural waste, which mobilizes the nutrients and also reduces the harmful toxins and kills the pathogens that cause disease to agricultural crops. The use of compost as a nutrient source in agriculture is more eco-friendly than chemical fertilizers.

Coriander (*Coriandrum sativum* L.) is one of the most important vegetables, spices and is also a medicinal plant which belongs to the family Apiaceae (Umbelliferae) and is mostly cultivated from its seeds throughout the year. This is an aromatic plant and has several uses in the food and other industries. Plants have played a major role in maintaining human health and shaping civilization for thousands of years.[6] The leaves and seeds are widely used as spices and flavour enhancers in foods worldwide.

The productivity of coriander is influenced by several factors such as soil, variety, fertilizer management, and various agro techniques used for growing the crop. Nutrients play a vital role in the functioning of normal physiological processes during the period of growth and development of plants. However, for obtaining a higher economic yield, a balanced supply of nutrients is one of the key factors. Most of the time, coriander crop is grown for herbage purposes, where continuous availability of all essential nutrients is a very prime requirement, especially nitrogen. This can be effectively achieved by applying organic manures as they release the nutrients slowly up on decomposition may help in steady availability throughout the crop life cycle.[10, 2] The Previous study also indicates that Organic fertilizers enhance soil fertility, soil structure, water-holding capacity, bulk density, aeration, and porosity and chemical properties, soil pH, microbial activity and increment in crop yield.[1, 4] Ultimately manures are recognized as one of the most important and effective inputs in improving soil fertility and crop production.[13] Organic manures also enhance the availability of native N, P, K, and other essential nutrients in the soil.[14] Inorganic nutrient management has adverse residual effects such as nutrient loss, surface water and groundwater contamination, soil acidification or basification, reductions in useful microbial communities, and increased sensitivity to harmful insects.[3] These side effects upsurge in a short-duration crop like coriander gowns for herbage purposes as they have excess

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unutilized chemical nutrients. Hence, this experiment was conducted to quantify the compost to be added to get the economic yield of coriander and its effects on growth and yield parameters in relation to the inorganic nutrient management system.

## Materials and Methods

The experiment was conducted at the School of Agricultural Sciences and Forestry, RTU Bengaluru. The experimental site has red soil with a moderate slope and a medium range of soil nutrient status. The experiment was laid out with a randomized complete block design (RCBD) with 5 treatments and 4 replications. The treatments were allotted using randomization technique and experiment comprising 5 treatments viz., $T_1$: Control; $T_2$: RDF (90-80-50 kg/ha NPK); $T_3$: Compost 5 t/ha; $T_4$: Compost 10 t/ha; $T_5$: Compost 15 t/ha. The number of inputs in each treatment was thoroughly measured and applied to the respective plot.

In the case of compost treatment, the same was prepared by VAT method using all types of waste material available at the farm. Four months old mature compost was spread to respective experimental plots 15 days in advance and mixed thoroughly to facilitate further decomposition and release of nutrients on time.

The field was thoroughly prepared by passing wooden flow twice and brought to a fine tilth by passing cultivator. The Arka Isha variety of coriander crops was line sown at a seed rate of 10kg/ha with 22 x15 cm spacing. Arka Isha is bushy in nature, having broad leaves, with good aroma, good keeping quality, and also rich in vitamin C. Two manual weddings were taken at 15 days intervals *i.e.* 15DAS and 30DAS. The crop was irrigated by flooding the plot separately at 3 days intervals. No pest or disease attacked the experimental crop, but as a preventive measure, organic repellants were used at 15DAS. The crop was harvested at the full green stage *i.e.* 45 days after planting.

Data on plant height (measured from the base of the plant to the tip of the main shoot), number of leaves (green trifoliate leaves present on each plant were counted manually), and number of branches (each branch from the main shoot counted) were recorded at 15DAS And at harvest, root length, fresh and dry foliage per plant, total herbage yield was recorded. For observation, 10 plants in each treatment were measured, and the mean was calculated. The data recorded on different growth and yield parameters are subjected to statistical analysis using the Completely Randomized Design technique. Analysis was carried out by taking the average of ten plants from each plot and by using analysis of variance (ANOVA). Critical difference (CD) values were calculated for the $p$=0.05 whenever the "F" test was found significant.

## Results and Discussion

### Plant height of coriander

The results obtained on plant height of coriander at 15DAS and at harvest are shown in Table 1. Plant height was increased significantly to 8.67 cm by application of 15 t/ha compost at 15DAS over control (5.53cm) which is on par with the application of RDF (7.57cm). Further plant height at harvest was significantly increased by application of compost at 10 t/ha (20.71cm) compared to control (12.33 cm), and it is on par with the application of RDF and compost at the rate of 15 t/ha, 19.66 cm and 20.54 cm respectively. Continuous availability and adequate supply of nutrients, including micronutrients due to compost application, may have helped achieve maximum height in compost treatment[15] besides a good physical soil condition due to the addition of organic matter to soil through compost. The results are in line with the findings of Rania et al. (2022),[18] who demonstrated that compost application (50m$^3$compost/ha) resulted in a significant increase in plant height and seed yield of coriander as compared with the control. These results are also in line with Vadiraj & Siddagangaiah (1998)[24] Yogesh et al. (2016),[26] who reported superior growth factors of coriander under the organic nutrient management system.

**Table 1: Effect of different levels of compost on growth parameter of coriander at 15 DAS and at Harvest (45 DAS)**

| Treatments | Plant height (cm) | | Number of leaves | | Number of branches | |
|---|---|---|---|---|---|---|
| | At 15 DAS | At Harvest (45DAS) | At 15 DAS | At Harvest (45DAS) | At 15 DAS | At Harvest (45DAS) |
| $T_1$: Control | 5.53 | 12.33 | 5.00 | 13.33 | 3.00 | 4.33 |
| $T_2$: RDF | 7.57 | 19.66 | 6.00 | 20.67 | 4.00 | 7.27 |
| $T_3$: Compost 5 t/ha | 7.32 | 16.87 | 7.00 | 18.47 | 4.10 | 6.47 |
| $T_4$: Compost 10 t/ha | 8.52 | 20.71 | 7.27 | 21.57 | 4.18 | 7.80 |
| $T_5$: Compost 15 t/ha | 8.67 | 20.54 | 7.23 | 21.17 | 4.11 | 7.17 |
| SEm | 0.35 | 1.32 | 0.52 | 1.30 | 0.26 | 0.49 |
| CD(p=0.05) | 1.13 | 4.29 | NS | 4.25 | NS | 1.59 |

### Number of branches of coriander

The numbers of coriander branches at 15 DAS and the harvest are given in Table 1. The application of RDF and different levels of compost was not significant concerning the number of branches at 15 DAS. However, the highest number of 4.18 branches was recorded in treatment receiving compost at 10t/ha followed by 4.10 in compost 5t/ ha and 4.00 in RDF treatment. The number of branches at the time of harvest was least in the control treatment (4.33), which increased significantly to 7.80 in treatment receiving compost 10t/ha followed by RDF (7.27) treatment. These results conform with the findings of Rajesh *et al.* (2015)[17] Vedpathak & Chavan (2016)[25] Ashwini & Jain (2017)[5] Fateme (2021)[9], who reported that organic cultivation of coriander produced superior results in growth parameters.

### Number of leaves of coriander

The nutrient management from different sources has no significant effect on the number of leaves (Table.2). However, the highest number of leaves was found in compost 10 t/ha (7.23), followed by Compost 5 t/ha and RDF treatment (7.00 and 6.00 respectively). Further, significant variation in several leaves was found at the time of harvest among different treatments. A significantly superior number of leaves, 21.57, was found in compost 10t/ ha treatment compared to 13.33 in the control. But it was on par with the RDF and compost at 5 t/ha with 20.67 and 18.47, respectively. The findings of Yogesh et al. (2016)[26] and Rania et al. (2022)[18] are in line with the results of the present investigation.

Table 2: Effect of different levels of compost on Yield parameters

| Treatments | Root length (cm) at harvest | Green foliage yield per plant (g) | Dry foliage yield per plant (g) |
|---|---|---|---|
| $T_1$: Control | 3.64 | 15.68 | 0.67 |
| $T_2$: RDF | 5.69 | 19.95 | 1.82 |
| $T_3$: Compost 5 t/ha | 5.15 | 16.04 | 1.60 |
| $T_4$: Compost 10 t/ha | 5.76 | 20.22 | 1.87 |
| $T_5$: Compost 15 t/ha | 5.68 | 19.72 | 1.80 |
| SEm | 0.25 | 0.70 | 0.05 |
| CD(p=0.05) | 0.76 | 2.16 | 0.15 |

### Root length

Different nutrient management practices produced significant variations concerning the root length of coriander (Table.2). Statistically, a superior root length of 5.76 cm was found in treatment receiving compost 10t/ha followed by RDF (5.69 cm) and the least was found in the control treatment (3.64 cm). The root length of compost application at the rate of 15t/ha (5.68cm) was on par with RDF and 10t/ha compost application. The root length of compost 10 t/ha and RDF were on par with each other but significant over control. The increase in root length in compost treatment may be attributed to the easy penetration of roots to deeper layers due to the good physical condition of soil improved by the action of compost upon decomposition. As we know, the addition of organic matter reduces the bulk density of soil[11] and makes it less compact and less resistant to penetration of roots. The results obtained by Sakthivel *et al.* (2020)[20] Anchal et al. (2021),[19] who used organic fertilizers for coriander cultivation, align with the present findings.

### Green and dry foliage yield per plant

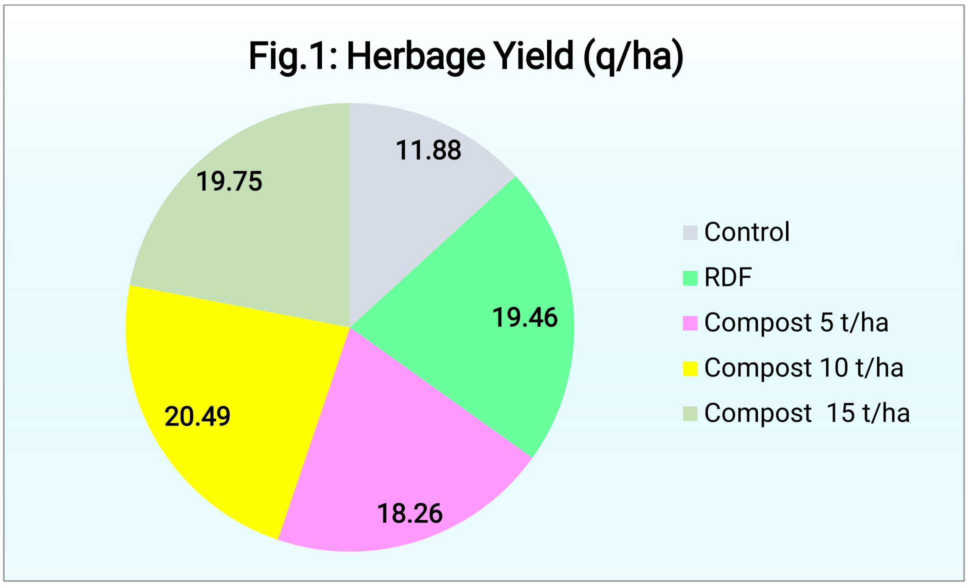
The data is presented in Table.2 shows that the green foliage yield per plant in control is 15.68 g which increased significantly to 20.22g in treatments receiving compost 10t/ha, which is on par with the RDF treatment (19.95g). A similar trend was also observed in dry foliage per plant parameter where compost at 10t/ha produced the highest dry foliage yield of 1.87 g, which is significant over control (0.67) but at par with RDF (1.82). The superiority in growth parameters due to compost application helped in the good assimilation of photosynthates which is significantly reflected in foliage yield. These results are in agreement with the findings of Donega et al. (2013)[7] Rajesh et al. (2015)[17] Sakthivel et al. (2020)[20], who reported that the application of organic manure produced superior green and dry foliage yield.

### Total herbage yield

The results obtained on fresh herbage yield of coriander at 15 DAS and at harvest are given in Fig.1. The biomass of coriander significantly differed due application of different levels of compost. The yield of coriander was significantly increased by the application of compost at 10t/ha (20.49 q/ha) over control (11.88 q/ha), but it was on par with compost at 15 t/ha and RDF (19.75 and 19.46 q/ha, respectively). The increase in yield may be due to the continuous availability of nutrients during the mineralization of compost[8], increasing uptake of nutrients by coriander due to the timely availability of nutrients upon decomposition[10] and improvements in soil characteristics, the elevation of pH, and maintenance of plant hormones production that stimulate plant development.[21] Similar results were also obtained by Moslemi et al. (2012)[12], Vedpathak & Chavan (2016),[25] Rajesh et al. (2015),[17] Suman et al. (2018)[22], Priyadarshini et al. (2017)[16], Tamilarasi et al. (2020)[23] and Sakthivel et al. (2020)[20] where they suggested that organic manuring has a positive effect on yield of coriander crop.

Table 3. Effect of different levels of compost on herbage yield and B:C Ratio

| Treatments | Herbage Yield (q/ha) | B:C Ratio |
|---|---|---|
| $T_1$: Control | 11.88 | 0.79 |
| $T_2$: RDF | 19.46 | 2.30 |
| $T_3$: Compost 5 t/ha | 18.26 | 2.07 |
| $T_4$: Compost 10 t/ha | 20.49 | 2.46 |
| $T_5$: Compost 15 t/ha | 19.75 | 2.42 |
| SEm | 0.40 | |
| CD(p=0.05) | 1.22 | |




### B:C Ratio

The B: C Ratio of the field experiment are tabulated in table 3. Application of compost at the rate of 10t/ha produced the highest B: C Ratio (2.46), followed by treatment compost at a rate of 15t/ha and RDF (2.42 and 2.30, respectively). The least was found in the control treatment (0.79).

## Conclusion

Compost is one of the best low-cost farm waste recycling technologies, which is provides high-value organic nutrients essential for plant growth and development. According to the field experiment, it may be concluded that the application of compost at a rate of 10t/ha produced the highest growth, yield parameters, and herbage yield compared to all other levels. The yield obtained in compost at a rate of 10t/ha was on par with the yield of RDF. As the results depict, compost may be an economical alternative to chemical fertilizers, and 10t/ha will be more economical in all terms. The nutrition input through compost not only produced an economical yield but also effectively utilized farm waste and reduced the cost of cultivation without impairing environmental quality.

### Declaration of interests

The authors have no conflict of interest to declare.

### Data sharing

All relevant data are within the manuscript.

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