Growth, yield and economics of coriander (*Coriandrum sativum* L.) influenced by organic and inorganic fertilizers

ABSTRACT:

The experiment laid out with an eighteen treatment combination of organic manures (vermicompost and neem cake) along with bio-fertilizer (*Trichoderma viridae*) and inorganic fertilizers in a randomised block design that was duplicated three times. During the year 2024-25 at Horticultural Research Farm, School of Agricultural Sciences, Malla Reddy University, Hyderabad. The treatments used were T_1: Check, T_2: NPK (100%), T_3: RDN (100%) + Vermicompost, T_4: N (75%) + Vermicompost + *Trichoderma*, T_5: RDN (100%) + Neem cake, T_6: N (75%) + Neem cake + *Trichoderma*, T_7: RDN (100%) + Vermicompost + Neem cake, T_8: N (75%) + Vermicompost + Neem cake +*Trichoderma.* Among all the treatments the treatment T_7: RDN (100%) + Vermicompost + Neem cake was found to be most effective in terms of growth characters such as plant height (46.9 cm), number of branches per plant (10.5) number of leaves per plant (10.6), leaf yield per plant (3.4g), umbels per plant (41.5), umbellate per umbels (7.9), seeds per umbellate (6.4), seed yield per plant (7.7g), seed yield per ha (25.8q) and highest B: C ratio (1.7).

KEYWORDS: *Coriandrum sativum*, Inorganic Fertilizers, Neem Cake, Trichoderma and Vermicompost.

1. INTRODUCTION

Organic farming is getting more popular these days, which accentuates shift from high volume production system to high value production system. Coriander (*Coriandrum sativum* L.) a common condiment crop in the tropics, is used in a variety of cuisines and food courts. This annual herbaceous plant is a member of the Apiaceae family. India is the world's top producer, consumer, and exporter of coriander, primarily grown in Rajasthan. In India coriander is cultivated in an area of 6.2 lakh ha with a production of 8.29 lakh MT (National Horticulture

Board, 2023). The yield can vary based on region, farming practices, and weather conditions. Organic fertilizers play a crucial role in promoting the growth and yield of coriander by enhancing the soil health, increasing the nutrient uptake, improves root development, accumulation of bio mass and reduces the environmental pollution. Organic manures and biofertilizers including Farm Yard Manure (FYM), goat manure, vermicompost, and nitrogen-fixing bacteria have reduced the use of chemical fertilizers while providing higher quality products free of hazardous agrochemicals for human safety. Application of organic inputs can have a huge additive impact to improve the efficiency of fertilizer use by increasing the microbial activity of soil. (Sharma S K, *et al.,* 2021). Several studies have reported that vermicompost can increase the growth and biomass of some medicinal plants such as chamomile (Fallahi *et al.,* 2008)

2. MATERIALS AND METHODS

A field experiment was conducted during rabi 2024-25 at Horticultural Research Farm, School of Agricultural Sciences, Malla Reddy University, Hyderabad. Telangana, India. The experiment was laid out in randomized block design with eight treatments three replications, *viz*. T_1: Check (FFP), T_2: NPK (100%), T_3: RDN (100%) + Vermicompost, T_4: N (75%) + Vermicompost + *Trichoderma*, T_5: RDN (100%) + Neem cake, T_6: N (75%) + Neem cake + *Trichoderma*, T_7: RDN (100%) + Vermicompost + Neem cake, T_8: N (75%) + Vermicompost + Neem cake +*Trichoderma.* Seeds were sown in 3 m × 1m plots with a spacing of 30 cm × 10 cm. The recommended dosages of NPK @ 30: 40: 20 kg/ha were applied in the form of urea, single super phosphate and muriate of potash respectively. Urea was applied accordingly treatment wise in first basal application and the other two doses at 25 and 50 days after sowing. The entire dose of single super phosphate and muriate of potash were applied at the time of sowing as basal dose. The vermicompost and Trichoderma were incorporated in to respective plots just prior to sowing of seed and then slightly covered with the fine soil. The neem cake was applied at the time of sowing. Need based cultural and plant protection operations were taken up to the leaf harvest. The experimental data recorded for growth attributes, yield parameters and economics were statistically analyzed for level of significance.

3. RESULTS AND DISCUSSION

3.1 Growth Parameters

Growth parameters such as plant height, number of branches per plant and number of leaves showed significant variation with different doses of fertilizers and biofertilizers at 30, 60 and 90 days after sowing. The results revealed that the effect of different nutrient sources combination significantly affected the growth parameters (Table and Fig. 1). The maximum plant height (16.50 cm), was recorded at 30 days after sowing with the treatment combination T_7 which was closely followed at par with the T_8 The lowest plant height was recorded with the treatment T_1 (9.80 cm) control plot without application of any fertilizers. The similar results also found into the number branches and number of leaves with treatment combination of T_7, on par with T_8 and lowest in T_1. Similar results for most of the characters were also reported by Peerzada *et al.* (2016), and Swain *et al*. (2020).

The results revealed that the effect of different nutrient sources combination significantly affected the growth parameters at 60 days after sowing. The maximum plant height (34.30 cm), was with the treatment combination T_7 (RDN (100 %) + vermicompost @ 5t/ ha+ Neem cake @ 2t/ ha), which was closely followed at par with the T_8 (32.00 cm) with (N (75 %) + Vermicompost @ 5t/ ha + Neem cake @ 2t/ ha+ *Trichoderma viridae*). The lowest plant height was recorded in T_1 (19.20 cm) control. The similar results also found into the number branches and number of leaves with treatment combination of T_7, on par with T_8 and lowest in T_1.

The maximum plant height (46.9 cm), number of leaves (10.6), number of branches (10.5) were obtained at 90 days after sowing with the treatment combination where 100% RDN was given through inorganic sources (Vermicompost and Neem cake) which was closely followed at par with the T_8 (43.70 cm) with (N (75 %) + Vermicompost @ 5t/ ha + Neem cake @ 2t/ ha+ *Trichoderma viridae*). The lowest plant height in (27.50 cm) was recorded in (T_1) control. The lowest plant height was recorded in T_1 (19.20 cm) control. The similar results also found into the number branches and number of leaves with treatment combination of T_7, on par with T_8 and lowest in T. The better results in plant height with spread due to the build-up of colonies by the applied bio-fertilizers inoculates along with organic manures as mentioned in different treatments. The significant differences in herbage and seed yield may be attributed to the higher levels of nutrients besides growth stimulating substances (enzymes, antibiotics and growth

hormones) available in vermicompost (Vadiraj *et al.* 1998). It was due to the application of vermicompost and neem cake enhanced the nitrogen and other nutrients availability, resulted in increased vegetative growth. Similar results were also reported by Sahu *et al.,* (2014), Tripathi *et al.,* (2013) and Hnamte *et al.,* (2013) in coriander who stated that synergistic effect of inorganic and organic fertilizer increased plant height.

3.2 Yield Parameters

Yield attributes are one of the most important factors for evaluating productivity under field conditions and are presented in Table 2 and Fig. 2. The highest leaf yield per plant (3.4), umbels per plant (41.5), umbellate per umbels (7.9), seeds per umbellate (6.4), seed yield per plant (7.74) and seed yield per hectare (25.8q) was reported with the treatment in which 100 % recommended dose of nitrogen was given through inorganic sources (Vermicompost and Neem cake) whereas lowest yield component was reported in control. The lowest plant height was recorded in T_1 (19.20 cm) control. The closely were results also found with different yield attributes and yield like leaf yield per plant, umbels per plant, umbellate per umbels, seeds per umbellate, seed yield per plant and seed yield per hectare with treatment combination of T_8 and lowest in T_1. The increase in growth and yield attributing characters due to biofertilizer inoculation along with organic and inorganic Nitrogen may be due to beneficial effect of biofertilizer on nitrogen fixation, production of phytohormone like substances and increase in uptake of nutrients such as nitrogen. (Govindan and Purushothaman, 1984) and Ibrahim *et al.* (2020). The combined effect of inorganic source and vermicompost played a very important role due to their synergistic effect. Application of vermicompost increased the supply of easily assimilated major as well as micronutrients to plants besides mobilizing unavailable nutrients into available form. Choudhary and Jat (2004), Jhariya S and Jain A (2016) were also reported similar findings in coriander. Similar results were also reported due to the combination of organic manures and chemical sources of nitrogen in cumin (Shivran *et al.,* 2017) and fennel (Gamar *et al.,* 2018).

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3.3 Economics

The results revealed that the effect of different nutrient sources combination significantly affected the economics (Table and Fig. 3). The highest B: C ratio (1.7) was observed with the

treatment combination of T_7 (RDN (100%) + Vermicompost + Neem cake) with cost of production (Rs. 1,21,7601/-) gross return (2,10,506/-) and net profit (88,746/-) and closely related results were also found in T_8 (1.6) with cost of production (Rs. 1,89,624/-) gross return (1,22,245/-) and net profit (67,379/-) and the lowest B: C ratio (1.2) was observed with the treatment combination of T_1 (control) with cost of production (Rs. 36,384/-), gross return (Rs. 30,000/-) and net return (Rs. 6,384/-). This might be due to better supply of nutrients to the plant, which led to higher production of growth and yield component of plant like leaf and seed of coriander which enhanced the economical parameters of coriander. These results are supported by the findings of Mehta *et al.* (2012), Tripathi *et al.* (2013), Dadiga *et al.* (2015) and Shivran *et al.* (2017).

4. CONCLUSION

It is clear from the present study that vermicompost, neem cake and Trichoderma successfully manipulate the growth and yield of coriander. Based on the experimental results it can be concluded that the application of 100% RDN through inorganic sources (Vermicompost and Neem cake) showed superior performance over other treatments which was at par with the treatments in which 75% recommended dose of nitrogen was provided through inorganic fertilizers and organic sources along with biofertilizer (Trichoderma). In addition to enhancing soil health the application of organic based fertilizers in an integrated manner with chemical fertilizers can substitute the fertilizer which will can be helpful in the development and production of coriander.

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TABLE 1. EFFECT OF ORGANIC AND INORGANIC FERTILIZERS ON GROWTH PARAMETERS

Treatment	Plant height (30 DAS)	Plant height (60 DAS)	Plant height (90 DAS)	Number of branches/plant (30 DAS)	Number of branches/plant (60 DAS)	Number of branches/plant (90 DAS)	Number of leaves/plant (30 DAS)	Number of leaves/plant (60 DAS)	Number of leaves/plant (90 DAS)
T_1	9.80	19.20	27.50	3.40	5.40	7.40	5.40	7.50	8.10
T_2	10.30	21.30	28.70	3.70	6.40	7.70	6.00	8.10	8.30
T_3	12.40	27.30	32.80	3.90	7.30	7.90	6.10	8.30	8.50
T_4	14.50	29.40	37.30	4.50	7.50	9.40	6.10	8.50	9.30
T_5	11.40	27.50	32.00	3.90	7.30	8.50	6.10	8.30	8.20
T_6	13.30	27.20	33.50	4.40	7.30	9.10	6.30	8.20	8.80
T_7	16.50	34.30	46.90	4.90	8.50	10.50	7.10	9.30	10.60
T_8	15.40	32.00	43.70	4.70	7.90	9.90	6.40	8.80	9.90
SEm ±	0.11	0.46	0.65	0.13	0.10	0.10	0.18	0.06	0.06
CD at 5%	0.34	1.40	1.99	0.42	0.32	0.31	0.55	0.21	0.21

TABLE 2. EFFECT OF ORGANIC AND INORGANIC FERTILIZERS ON YIELD PARAMETERS

Treatment	Leaf yield/plant (g)	Umbels/plant	Umbellate/umbels	Seeds/umbellate	Seed yield/plant (g)	Seed yield (q/ha)
T_1	2.30	32.80	4.50	4.00	1.26	4.20
T_2	2.40	34.60	5.20	5.00	1.49	5.00
T_3	2.60	37.40	5.80	5.00	4.59	15.30
T_4	2.70	37.90	6.50	5.00	4.46	14.90
T_5	2.60	35.60	5.80	5.00	3.46	11.50
T_6	2.60	37.50	6.00	5.00	4.16	13.90
T_7	3.40	41.50	7.90	6.00	7.74	25.80
T_8	3.10	39.40	7.40	6.00	6.91	23.00
SEm ±	0.05	0.19	0.08	0.07	0.07	0.24
CD at 5%	0.17	0.59	0.26	0.21	0.22	0.74

TABLE 3. ECONOMICS OF CORIANDER IN EFFECT OF ORGANIC AND INORGANIC FERTILIZERS

Treatments	Cost of production (ha)	Gross returns (ha)	Net returns (ha)	Benefit Cost Ratio
T1 - Control	30000	36384	6384	1.20
T2 - NPK (100%)	31760	42876	11116	1.30
T3 - RDN (100%) + Vermicompost @ 5t/ ha + *Trichoderma viridae* @ 2.5kg/ha	81760	125147	43387	1.50
T4 - N (75 %) + Vermicompost @ 5t/ ha + *Trichoderma viridae* @ 2.5kg/ha	81245	123973	42728	1.50
T5 - RND (100%) + Neem cake @ 2t/ ha	71760	97671	25911	1.40
T6 - N (75%) + Neem cake @ 2t/ha + *Trichoderma viridae* @ 2.5kg/ha	72245	107144	34899	1.50
T7 - RDN (100 %) + vermicompost @ 5t/ ha+ Neem cake @ 2t/ ha	121760	210506	88746	1.70
T8 - N (75 %) + Vermicompost @ 5t/ ha + Neem cake @ 2t/ ha+ *Trichoderma viridae* @ 2.5kg/ha	122245	189624	67379	1.60

Fig. 1. Effect of organic and inorganic fertilizers on growth parameters

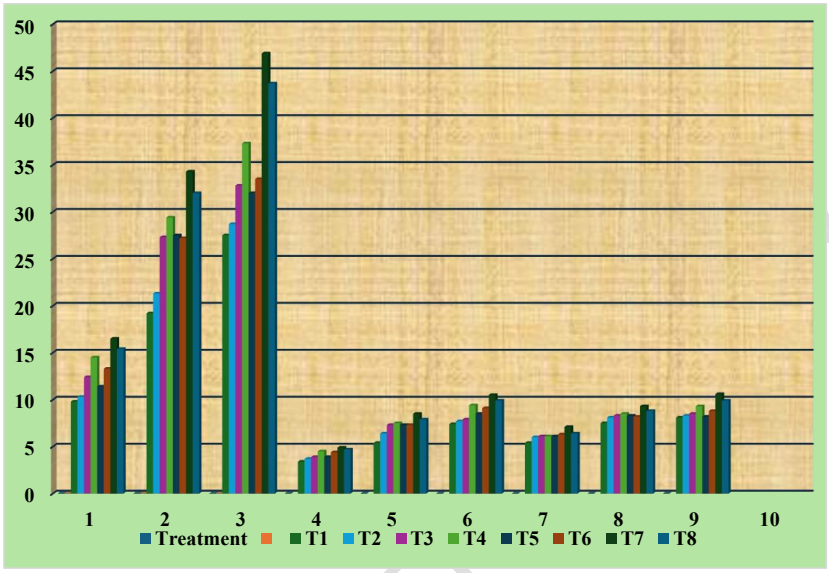

Fig. 2. Effect of organic and inorganic fertilizers on yield parameters

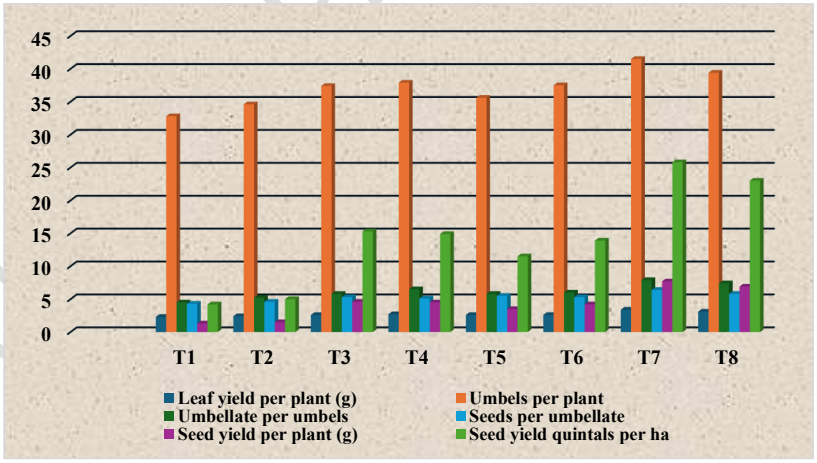

Fig. 3. Economics of coriander in effect of organic and inorganic fertilizers