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Influence of integrated nutrient management on seed yield of coriander (*Coriandrum sativum* L.)

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Abstract
A field experiment on "Influence of integrated nutrient management on seed yield of coriander (*Coriandrum sativum* L.)" was conducted during *Rabi* season of 2022-23 at Horticulture Research cum Instructional farm, BTC College of Agriculture and Research Station Bilaspur (C.G.) The experiment was carried out in RBD design with three replications and ten treatments *viz.* Absolute control (T_1), 100% RDN (T_2), 75% RDN (T_3), 75% RDN + 25% RDN through FYM (T_4), 75% RDN + 25% RDN through vermicompost (T_5), 75% RDN + Consortia (T_6), 50% RDN (T_7), 50% RDN + 50% RDN through FYM (T_8), 50% RDN + 50% RDN through vermicompost (T_9), 50% RDN + Consortia (T_{10}). The results reveal that maximum number of umbel plant^{-1} (44.03), seeds umbel^{-1} (43.67), test weight (10.27 g) and seed yield (14.07 q ha^{-1}) was recorded under the treatment (T_5)75 % RDN + 25 % RDN through vermicompost. Data revealed that in general integration of organics (vermicompost) with inorganic source of nitrogen (urea) exhibited a significant influence on seed yield as compared to sole application of various levels of nitrogen through urea.

Keywords: Coriander, umbel, seed, FYM, vermicompost, RDN

1. Introduction
Coriander, scientifically known as (*Coriandrum sativum* L.), is an herbaceous annual plant that is widely cultivated and used for its aromatic leaves and seeds. It belongs to the genus Coriandrum and family Apiaceae. In various part of country, coriander is also known as Dhaniya. The origin of coriander is believed to be in Egypt, Turkey, and the East Mediterranean region.

India holds the distinction of being the leading producer, consumer, and exporter of coriander worldwide. It accounts for approximately 80% of the total global output of coriander. India's coriander cultivation covers 6,62,000 hectares, achieving an average yield of 1.26 metric tonnes per hectare, with an annual yield of 8,32,000 metric tonnes (Agricultural Statistics at a Glance, 2021). Bilaspur, a district in Chhattisgarh, has 1,259 hectares dedicated to coriander seed farming, resulting in an average productivity of 0.29 metric tonnes per hectare. The state's coriander production is 910 metric tonnes, cultivated on 3020 hectares of land (Directorate of Horticulture, Government of Chhattisgarh, Raipur 2021-22).

Excessive use of chemical fertilizers can negatively impact soil health, human well-being, and produce quality. It is not recommended to use chemical fertilizers frequently. Integrating organic and inorganic components is more effective in improving yield, quality, and nutrient absorption. Combining organic and inorganic plant nutrients, along with biofertilizers, can increase sustainable yield and improve soil and environmental quality in coriander cultivation. Implementing effective nutrition programs that integrate different nutrient sources not only enhances the profitability and sustainability of farming but also promotes environmental friendliness. It is important to address the question of which nutrient sources, or combinations thereof, would be cost-effective and efficient for coriander production.

2. Material and Methods
The field experiment titled Influence of integrated nutrient management on seed yield of coriander (*Coriandrum sativum* L.) was conducted during the *Rabi* season of 2022-23 at the Horticulture Research cum Instructional Farm, BTC College of Agriculture and Research Station Bilaspur (C.G.). The experiment was carried out in RBD design with three replications and ten treatments *viz.* Absolute control (T_1), 100% RDN (T_2), 75% RDN (T_3), 75% RDN + 25% RDN through FYM (T_4), 75% RDN + 25% RDN through vermicompost (T_5), 75% RDN

+ Consortia (T_6), 50% RDN (T_7), 50% RDN + 50% RDN through FYM (T_8), 50% RDN + 50% RDN through vermicompost (T_9), 50% RDN + Consortia (T_{10}). The seeds were sown on 9th November 2022. The recording of observations was done 30 DAS and subsequent readings were recorded after every 30 days interval. The crop was harvested on 11th March 2023. The field was ploughed using a tractor-drawn plough, followed by harrowing and planking. Stubbles were removed, and plots were laid out using manual labor according to the experimental design.

The manures and fertilizers were applied to the plots according to the treatment combinations. FYM and vermicompost were incorporated into the soil before sowing. The recommended dose of nitrogen (80 kg ha^{-1}) was applied using Urea in two split doses, with half of the dose at the time of sowing and the remaining half after 30 days of sowing, for treatments where nitrogen was supplied through an inorganic source. The recommended dose of phosphorus (60 kg ha^{-1}) was applied using single superphosphate (SSP), and potassium (40 kg ha^{-1}) was applied using muriate of potash (MOP) for all treatments at the time of sowing. A consortia was applied as a seed treatment at a rate of 10 ml kg^{-1} of seed. For proper growth and development seed rate of 15 kg ha^{-1} is followed. Prior to sowing, the seeds were split into two halves to remove dormancy and soaked in water for 12 hours. After draining, the seeds were allowed to dry in shade for 1 hour. Then treated with Carbendazim at a rate of 2g kg^{-1} seed to prevent seed-borne diseases. In treatments containing consortia, the seeds were additionally treated with 10 ml kg^{-1} seed of the specific consortia just after treating with fungicide. The treated seeds were sown in furrows at 2 to 2.5 cm depth, lightly covered with soil, and watered for germination. Thinning was done 25-30 days after germination to maintain proper spacing (30x10) and achieve an optimum plant population. Observations were taken at 30, 60, 90, and 90 days after sowing and harvest. The statistical analysis of the investigation involved comparing the calculated 'F' variance ratio to the table value at a 5% level of significance. If the calculated value exceeded the table value, the effect was considered significant. The significant difference between means was tested against the critical difference at the same level of significance.

3. Result and Discussion

3.1 Number of umbel plant^{-1}

The number of umbels plant^{-1} was significantly influenced by the different combinations of nutritional sources. The statistical analysis showed a significant difference among the treatments in terms of the number of umbels plant^{-1}. The treatment T_5 (75% RDN + 25% RDN through vermicompost) exhibited the maximum number of umbels plant^{-1}, with a value of 44.07 which was significantly superior over other treatments but was at par with the treatment T_2 (100% RDN) and T_4 (75% RDN + 25% RDN through FYM) which also showed a comparable number of umbels plant^{-1}. The use of sufficient amounts of inorganic and organic fertilizer during the earliest stages of growth led to the survival of a greater number of flowers with a high supply of photosynthates, which in turn led to a greater number of umbels plant^{-1}. These findings align with previous investigations conducted by Diwan *et al*., (2018) [5] and Parihar *et al*., (2023) [9].

3.2 Number of seeds plant^{-1}

The number of seeds umbel^{-1} was significantly influenced by the different combinations of nutritional sources. Maximum number of seeds umbel^{-1} was recorded under the treatment T_5 (75% RDN + 25% RDN through vermicompost) with a value of 43.67 which was significantly superior over other treatments but was at par with the treatment T_2 (100% RDN) and T_4 (75% RDN + 25% RDN through FYM) which were statistically similar to each other in terms of seeds umbel^{-1}. The increased number of seeds umbel^{-1} could be attributed to the provision of abundant nutrients through chemical fertilizers and organic manure such as vermicompost. This supplementation likely led to enhanced carbohydrate accumulation and efficient remobilization of carbohydrates to the reproductive parts of the plant, which serve as the nearest sink. As a result, there was an increase in flowering, fruiting, and seed formation, ultimately leading to a higher number of seeds umbel^{-1}. These findings are consistent with the findings reported by Diwan *et al*., (2014) [13], Kheemraj *et al*., (2022) [7], and Parihar *et al*., (2023) [9] in coriander.

3.3 Test weight (g)

The test weight was significantly influenced by the different combinations of nutritional sources. Maximum test weight (10.27 g) was recorded under the treatment T_5 (75% RDN + 25% RDN through vermicompost) which was significantly superior over other treatments but was at par with the treatment T_2 (100% RDN) and T_4 (75% RDN + 25% RDN through FYM) which showed similar performance in terms of test weight. The highest test weight might be due to nutrient supply from organic and inorganic sources, allowing optimal dry matter partitioning during reproductive stages. This leads to improved vegetative growth, increased photosynthetic activity, and better water and nutrient extraction from soil depth, ultimately enhancing plant growth and yield. These findings are consistent with the findings reported by Nareshbhai (2019) [8], Godara *et al*., (2014) [6], and Yadav (2010) [12] in coriander.

3.4 Seed yield (q ha^{-1})

The seed yield per hectare was significantly influenced by the different combinations of nutritional sources. The statistical analysis revealed a significant difference among the treatments in terms of the seed yield per hectare. The treatment T_5 (75% RDN + 25% RDN through vermicompost) exhibited the maximum seed yield per hectare, recording a value of 14.28 q ha^{-1} which was significantly superior over other treatments but was at par with the treatment T_2 (100% RDN) and T_4 (75% RDN + 25% RDN through FYM) which also showed high seed yields per hectare.

The probable reason for the higher seed yield of coriander might be due to an adequate supply of nutrient elements at the right time from the combined application of organic and inorganic sources which helped optimum dry matter partitioning from the source to sink during the reproductive stage of the plant and its effect on improved vegetative growth which ultimately lead to increase in photosynthetic activity of plant and root system and thus enabled the plant to extract more water and nutrients from the soil depth, resulting into better development of plant growth and ultimately the higher seed yield.

The application of vermicompost contributed to an increased supply of readily assimilable major and micronutrients to the plants. Additionally, it aided in mobilizing nutrients that were previously unavailable, making them accessible to the plants.

Similar findings in coriander were also reported by Choudhary and Jat (2004) [14]. The higher seed yield can be attributed to the increased availability of nutrients, which has led to the production of a greater seed yield. The impact of vermicompost application on coriander yield is also supported by previous findings obtained by Baratwal *et al*., (2021) [15], Sharangi *et al*., (2005) [10] and Kheemraj *et al*., (2022) [7].

Table 1: Influence of integrated nutrient management on number of umbels plant^{-1}, number. of seeds umbel^{-1}, Test weight (g) and seed yield (q ha^{-1}) of coriander.

	Treatments	No. of umbels plant^{-1}	No. of seeds umbel^{-1}	Test weight (g)	Seed yield (q ha^{-1})
T_1	Absolute control	25.07	26.8	7.80	5.84
T_2	100% RDN	43.33	43.2	10.11	13.15
T_3	75% RDN	37.33	39.23	9.09	10.87
T_4	75% RDN + 25% RDN through FYM	41.67	41.37	9.88	12.86
T_5	75% RDN + 25 % RDN through vermicompost	44.03	43.67	10.27	14.07
T_6	75% RDN + Consortia	41	41.27	9.69	12.71
T_7	50% RDN	33.67	37.3	8.5	7
T_8	50% RDN + 50% RDN through FYM	35.67	38.63	8.77	9.8
T_9	50% RDN + 50% RDN through vermicompost	37.33	39.2	9	10.01
T_{10}	50% RDN + Consortia	35.33	38.03	8.2	9.01
	CD	5.976	3.497	0.800	2.318
	SE(m)	1.996	1.168	0.267	0.774
	SE(d)	2.823	1.652	0.378	1.095
	CV	9.233	5.204	5.063	10.911

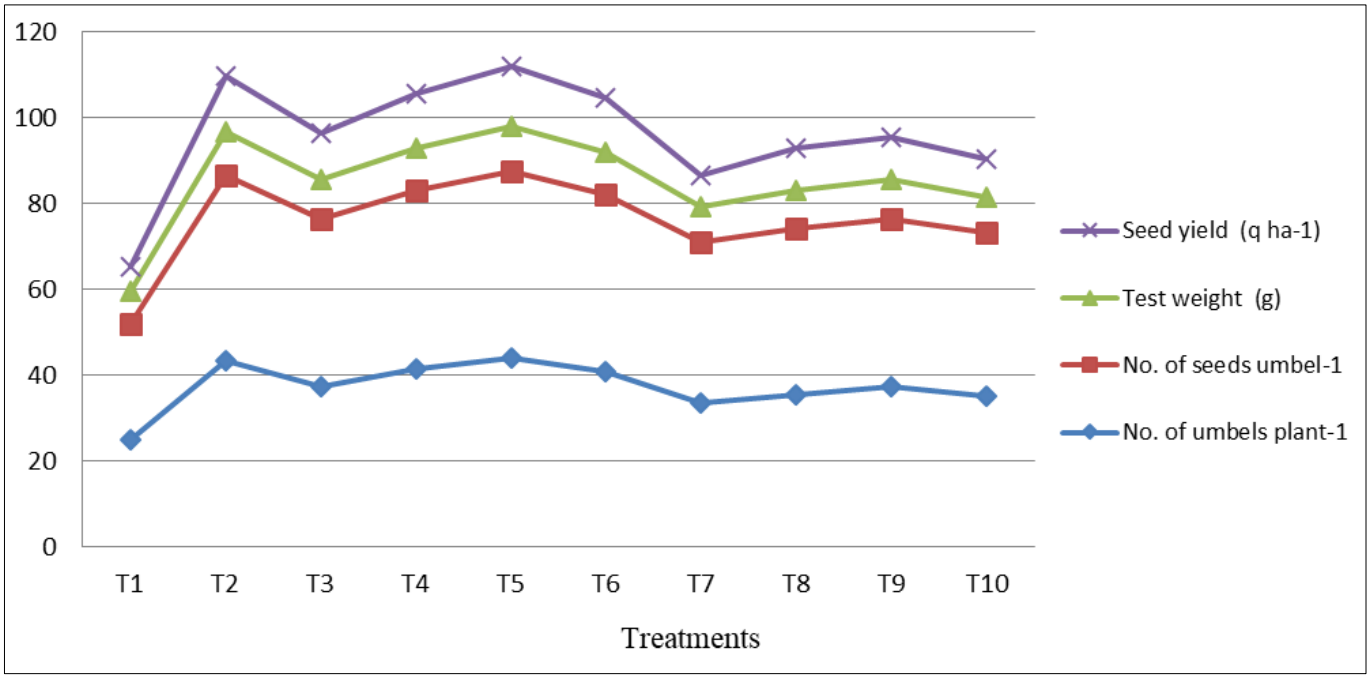

Fig 1: Influence of integrated nutrient management on number of umbels plant^{-1}, number of seeds umbel^{-1}, Test weight (g) and seed yield (q ha^{-1}) of coriander.

4. Conclusion

In the view of the results obtained from the present investigation, it can be concluded that for getting higher seed yield of coriander it should be fertilized with 75% RDN + 25% RDN through vermicompost.

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