

Integrated nutrient management in coriander (*Coriandrum sativum*)

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ABSTRACT

The field study was carried out to study the integrated nutrient management in coriander (*Coriandrum sativum* L.) var. GCo-3" during *rabi*, 2023-24 at Regional Horticultural Research Station, ASPEE College of Horticulture, NAU, Navsari, Gujarat, India. The experiment was conducted in randomized block design with ten treatments and three replications consisting of *viz.* T₁: FYM 10 t/ha and 100 % RDF (60:30:00 kg NPK/ha), T₂: FYM 5 t/ha + 75 % RDF, T₃: FYM 10 t/ha + 50 % RDF, T₄: vermicompost 2 t/ha + 75 % RDF, T₅: vermicompost 4 t/ha + 50 % RDF, T₆: biocompost 2 t/ha + 75 % RDF, T₇: biocompost 4 t/ha + 50 % RDF, T₈: FYM 5 t/ha + 50 % RDF + 1 % novel organic liquid nutrients, T₉: vermicompost 2 t/ha + 50 % RDF + 1 % novel organic liquid nutrients and T₁₀: biocompost 2 t/ha + 50 % RDF + 1 % novel organic liquid nutrients. The application of FYM 5 t/ha + 50 % RDF + 1 % novel organic liquid nutrients (T₉) gave maximum plant height (24.17 cm, 60.71 cm, 112.15 cm and 116.29 cm), highest number of primary branches/plant (1.90, 2.67, 4.07 and 4.27), total number of branches/plant (7.60, 9.53, 11.80 and 15.40), petiole length (21.18 cm, 18.68 cm, 13.50 cm and 8.48 cm) and leaf length (3.52 cm, 3.67 cm, 3.77 cm and 3.85 cm) 30, 60, 90 days and at harvest after sowing, respectively. Maximum number of umbels/plant (17.47), number of umbellates/umbel (5.87), number of seeds/umbellates (7.93), highest seed weight/plant (5.94 g), test weight of (000 seed weight) (14.33 g), seed yield (2002.93 kg/ha) and straw yield (2541.67 kg/ha) as well as oil yield (14.21 kg/ha) were observed under application of FYM 5 t/ha + 50 % RDF + 1 % novel organic liquid nutrients (T₉). The highest benefit:cost ratio (1.79) and maximum net realization (1,35,062 ₹/ha) were obtained under FYM 5 t/ha + 50 % RDF + 1 % novel organic liquid nutrients (T₉). Whereas, application of FYM 10 t/ha + 50 % RDF (T₃) improved soil nutrient status.

Key words: Nutrient, Growth, Yield, Quality, Integrated nutrient management

Coriander (*Coriandrum sativum* L.) is an annual herbaceous plant. India is the top producer of coriander in reference to an area of 5.53 lakh ha and a production of 7.35 lakh MT with an average yield of 1.32 MT ha⁻¹. In Gujarat, 1.88 lakh MT of coriander was produced in an area of 1.25 lakh ha. Organic forms of nutrients such as FYM, vermicompost and biocompost, constitute a potential renewable source of nutrient supply to crops under all situations, as well as improving the physical condition of soil to replenish and maintain its humus status in order to continue the optimum condition for soil microorganisms activities (Gruhn *et al.*, 2000). Integrated nutrient management (INM) is the process of maintaining or adjusting soil fertility and supply of plant nutrients to an ideal level of growth, development and intended yield by optimizing the benefits from all possible sources of plant nutrients through the appropriate combination of chemical fertilizers and organic manures (Gadipe *et al.*, 2020). Novel organic liquid nutrients which was prepared from the sap of banana pseudostem which is contains enough essential nutrient and plant growth hormone for growth and development of crops (Desai *et al.*, 2016). Although a good deal of information is available on fertilizer application for higher production of coriander and so far FYM is the organic source which has

been used predominantly but meagre work has been done on vermicompost, bio compost and NOVEL as an organic source as far as coriander. Therefore, an experiment was conducted on integrated nutrient management in coriander.

MATERIALS AND METHODS

An field study was carried out, to study the "integrated nutrient management in coriander var. GCo-3" during *rabi*, 2023-24 at Regional Horticultural Research Station, ASPEE College of Horticulture, NAU, Navsari, Gujarat, India. The experiment was conducted in randomized block design with ten treatments and three replications consisting of *viz.* T₁: FYM 10 t/ha and 100 % RDF (60:30:00 kg NPK/ha), T₂: FYM 5 t/ha + 75 % RDF, T₃: FYM 10 t/ha + 50 % RDF, T₄: vermicompost 2 t/ha + 75 % RDF, T₅: vermicompost 4 t/ha + 50 % RDF, T₆: bio-compost 2 t/ha + 75 % RDF, T₇: bio-compost 4 t/ha + 50 % RDF, T₈: FYM 5 t/ha + 50 % RDF + 1 % novel organic liquid nutrients, T₉: vermicompost 2 t/ha + 50 % RDF + 1 % novel organic liquid nutrients and T₁₀: bio-compost 2 t/ha + 50 % RDF + 1 % novel organic liquid nutrients. Organics (FYM, vermicompost and bio-compost) were applied at the time of sowing whereas, inorganics (N-urea and P-SSP), i.e. nitrogen were applied in two equal splits mainly, half quantity of nitrogen with full dose of phosphorus were applied at basal and remaining half quantity of nitrogen applied as top dressed at 30 DAS.

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Table 1: Effect of integrated nutrient management on growth attributes of coriander cv. GCo 3

Treatment	Plant height (cm)			Number of primary branches/plant						Total number of branches/plant						Petiole length (cm)						Leaf length (cm)					
	30			60			90			At			30			60			90			30			60		
	DAS	DAS	harvest	DAS	DAS	harvest	DAS	DAS	harvest	DAS	DAS	harvest	DAS	DAS	harvest	DAS	DAS	harvest	DAS	DAS	harvest	DAS	DAS	harvest	DAS	DAS	harvest
T ₁	23.00	53.19	100.55	105.01	180	2.20	3.53	3.67	6.67	9.00	10.20	13.60	19.51	17.27	10.95	6.65	3.13	3.25	3.36								
T ₂	22.13	52.13	99.53	103.82	153	2.00	3.00	3.53	6.27	8.40	10.07	11.07	17.79	14.95	10.52	6.52	2.91	3.04	3.32								
T ₃	23.41	60.12	111.97	115.56	187	2.60	3.60	3.87	7.13	9.20	11.73	15.27	20.69	18.28	13.44	8.36	3.43	3.73	3.81								
T ₄	20.82	51.79	98.82	101.95	137	1.73	2.43	2.87	5.60	7.73	9.40	10.60	16.31	13.69	9.56	6.11	2.60	2.73	2.90	3.21							
T ₅	21.13	52.01	98.87	102.84	150	1.87	2.60	3.07	6.00	8.07	10.00	10.73	17.10	14.26	9.91	6.14	2.71	2.79	2.99	3.25							
T ₆	23.32	59.02	111.53	114.30	183	2.27	3.60	3.80	6.88	9.13	11.60	14.33	20.31	17.79	12.40	7.82	3.42	3.61	3.72	3.80							
T ₇	22.12	52.11	99.31	102.16	153	1.97	2.87	3.27	6.07	8.27	9.87	10.87	17.27	14.63	10.21	6.39	2.79	2.88	2.99	3.29							
T ₈	24.17	60.71	112.15	116.29	190	2.67	4.07	4.27	7.60	9.53	11.80	15.40	21.18	18.68	13.50	8.48	3.52	3.67	3.77	3.85							
T ₉	22.61	53.07	99.71	104.04	157	2.07	3.13	3.57	6.33	8.47	10.13	11.27	18.28	15.35	10.69	6.63	2.90	2.92	3.08	3.32							
T ₁₀	22.83	53.14	100.13	104.56	157	2.20	3.20	3.60	6.60	8.53	10.13	11.40	19.27	15.44	10.71	6.64	2.92	2.99	3.11	3.35							
S.E.m. (±)	0.68	2.32	3.79	3.71	0.10	0.13	0.19	0.21	0.30	0.31	0.51	0.64	0.83	1.04	0.72	0.42	0.18	0.18	0.17	0.15							
CD (5 %)	NS	6.93	11.36	11.09	0.30	0.40	0.55	0.64	0.89	0.91	1.54	1.91	2.50	3.12	2.17	1.27	0.55	0.53	0.50	0.45							
CV (%)	5.20	7.33	6.36	6.00	10.54	10.79	10.07	10.45	7.93	6.14	8.48	8.90	7.70	11.27	11.21	10.50	10.60	9.83	8.89	7.56							

Table 2: Effect of integrated nutrient management on yield, quality and soil nutrient status of coriander cv. GCo 3

Treatment	Yield-attributing characters							Quality contents			Soil nutrient status		
	Number of umbels/plant	Number of umbellates/ umbel	Number of seeds/ umbellates	Seed weight/ plant (g)	Test weight (000 seed weight in g)	Seed yield (kg/ha)	Straw yield (kg/ha)	Oil content in seed (%)	Oil yield (kg/ha)	Organic carbon (%)	Nitrogen (kg/ha)	Phosphorus (kg/ha)	
T ₁	15.07	4.73	6.73	4.91	13.00	1711.17	2243.47	0.68	11.59	0.84	309.33	43.36	
T ₂	14.53	4.60	6.53	4.82	12.67	1606.14	2166.34	0.66	10.54	0.77	298.54	47.59	
T ₃	17.40	5.60	7.67	5.92	13.83	1919.16	2459.38	0.69	13.27	0.88	335.38	52.61	
T ₄	13.87	4.40	6.40	4.54	12.17	1515.64	1976.85	0.65	9.92	0.76	299.27	50.38	
T ₅	14.20	4.53	6.47	4.68	12.33	1562.32	2003.47	0.65	10.10	0.80	322.44	50.13	
T ₆	17.33	5.47	7.53	5.74	13.33	1813.76	2297.45	0.69	12.57	0.83	325.64	49.33	
T ₇	14.33	4.53	6.47	4.78	12.50	1579.81	2062.50	0.66	10.37	0.84	306.45	47.28	
T ₈	17.47	5.87	7.93	5.94	14.33	2002.93	2541.67	0.71	14.21	0.87	330.82	52.44	
T ₉	14.80	4.67	6.53	4.86	12.67	1681.39	2225.69	0.67	11.32	0.80	295.02	51.50	
T ₁₀	14.93	4.67	6.60	4.88	13.00	1683.56	2186.34	0.67	11.20	0.84	309.66	49.19	
S.E.m. (±)	0.81	0.31	0.36	0.29	0.38	84.48	100.11	0.02	0.63	0.02	8.97	1.65	
CD (5%)	2.39	0.91	1.08	0.86	1.12	250.98	297.41	NS	1.88	0.06	26.64	4.92	
CV (%)	9.06	10.80	9.14	9.80	5.02	8.57	7.82	5.34	9.52	4.65	4.96	5.80	

Table 3: Effect of integrated nutrient management on economics of coriander

Treatment	Seed yield (kg/ha)	Treatment cost (Rs. ha ⁻¹)	Fixed cost (₹/ha)	Total cost (₹/ha)	Gross income (₹/ha)	Net income (₹/ha)	BCR
T ₁	1711.17	65,144	11,678.74	76,823.19	1,79,672.85	1,02,849.66	1.34
T ₂	1606.14	61,412	10,961.91	72,374.36	1,68,644.70	96,270.34	1.33
T ₃	1919.16	63,680	13,098.27	76,778.72	2,01,511.80	1,24,733.08	1.62
T ₄	1515.64	74,412	8,866.52	83,278.97	1,59,142.20	75,863.23	0.91
T ₅	1562.32	89,680	9,139.56	98,820.01	1,64,043.60	65,223.59	0.66
T ₆	1813.76	59,612	10,610.47	70,222.92	1,90,444.80	1,20,221.88	1.71
T ₇	1579.81	60,080	92,41.89	69,322.34	1,65,880.05	96,557.71	1.39
T ₈	2002.93	63,528	11,717.16	75,245.61	2,10,307.65	1,35,062.04	1.79
T ₉	1681.39	76,528	9,836.12	86,364.57	1,76,545.95	90,181.38	1.04
T ₁₀	1683.56	61,728	9,848.80	71,577.25	1,76,773.80	1,05,196.55	1.47

Note: Selling price of coriander seeds Rs.105/kg.

The foliar application of novel organic liquid nutrients was done at 25 and 50 days after sowing. The soil of the experimental plot was clay in texture with pH values for 15-30 cm depths is 7.75. The experimental field were prepared by one deep ploughing followed by one harrowing. Flat beds of 2.4 m x 2.4 m size were prepared and seed of coriander variety GCo. 3 was sown at 20 cm x 10 cm spacing during last week of November, 2023. The cultural practices and nutrient management (FYM @ 10 t ha⁻¹ with RDF @ 20:10:00 NPK kg/ha) were carried out as per the recommendations. Observations on different growth parameters was recorded 30 and 50 days after sowing from five randomly selected plants from each plots whereas, yield attributing characters were recorded at the time of harvesting. The quality parameters, *viz.* essential oil content was determined by using Clevenger type apparatus and the yield of essential oil was computed by formula. The chemical properties of the soil from the depth of 15-30 cm. were determined before and after the experiment by Jackson (1973) methods.

RESULTS AND DISCUSSION

The data revealed that, application of FYM 5 t/ha + 50 % RDF + 1 % novel organic liquid nutrients (T₈) significantly recorded maximum plant height (60.71 cm, 112.15 cm and 116.29 cm), highest number of primary branches/plant (1.90, 2.67, 4.07 and 4.27), total number of branches/plant (7.60, 9.53, 11.80 and 15.40), petiole length (21.18 cm, 18.68 cm, 13.50 cm and 8.48 cm) and leaf length (3.52 cm, 3.67 cm, 3.77 cm and 3.85 cm) 30, 60, 90 days and at harvest after sowing, respectively. FYM 5 t/ha + 50 % RDF + 1 % novel organic liquid nutrients (T₈) showed significant results among the treatment that might be due to high efficiency of INM combination (Sunanda *et al.*, 2014 and Kumari *et al.*, 2020). The novel organic liquid nutrients enhanced cell division and cell elongation (Suvarna, 2024; Manasa Bhat *et al.*, 2022 and Parikh *et al.*,

2023) and its combination with FYM, a narrow C:N ratio may produce more humic acid and humic substances, improving aeration and favouring beneficial microbial activity (Kumar *et al.*, 2016 and Manasa Bhat *et al.*, 2022).

The FYM 5 t/ha + 50 % RDF + 1 % novel organic liquid nutrients (T₈) gave maximum number of umbels/plant (17.47), number of umbellates/umbel (5.87), number of seeds/umbellates (7.93), highest seed weight/plant (5.94g), test weight of (000 seed) (14.33 g), seed yield (2002.93 kg/ha) and straw yield (2541.67 kg/ha). The higher values of yield might be due to be the effect of a perfect combination of integrated nutrients (FYM 5 t/ha + 50 % RDF + 1 % novel organic liquid nutrients), which contributed to the increased growth of plants in respect to the height of the plant and the number of leaves. The healthy plant growth and good soil conditions directly reflect on higher rate of photosynthesis, metabolites and nutrient uptake; thus, increased carbohydrate accumulation (Dhwani Bartwal *et al.*, 2022). The influence of novel organic liquid nutrients in yield attributes might be due to presence of a lavish amount of macro and micronutrients. The nutrients N and K at higher rate exerted a significant positive influence on yield. The enhancement of yield could have been further facilitated by optimizing the synthesis of carbohydrates and their efficient translocation to the potential storage organs through better growth and more number of branches per plant.

Essential oil content (%) recorded were failed to express their significant differences among the different treatments, but oil yield showed significantly higher (14.21 kg/ha) in FYM 5 t/ha + 50% RDF + 1% novel organic liquid nutrients (T₈). The higher oil yield with these treatments is attributed mainly to higher values of oil content and seed yields. Moreover, novel organic liquid nutrients increased the cation exchange capacity of roots and make them potent in absorbing other nutrient ions like H₂PO₄, K, *etc.* (Parikh *et al.*, 2023).

The treatments combination of FYM 5 t/ha + 50% RDF + 1% novel organic liquid nutrients (T_8) registered the highest net profit 1,35,062 ₹/ha with B:CR value of 1.79 as compared to rest of the treatments. This might be due to higher yield and lower investment in this treatment which in turns lead to maximum net profit as compared to other treatments. Similar results were obtained by Parikh *et al.* (2023) in turmeric.

The significantly higher organic carbon content (0.88%) in soil was recorded with application of FYM 10 t/ha + 50% RDF (T_3). The available N content (335.38 kg/ha) and P_2O_5 content (52.61 kg/ha) in soil was recorded significantly higher with the same treatment, i.e. FYM 10 t/ha + 50% RDF (T_3).

The complex organic cations chelate Al^{+3} , Fe^{+3} and Ca^{+3} and thus decrease the phosphate precipitating power of these cations and thereby increased in phosphorus availability with organic manure in higher quantity attributed to mineralization of organic phosphorus and production of organic acid making soil phosphorus more available (Dhwani Bartwal *et al.*, 2022 and Donga, 2014). Similar results were observed by Manasa Bhat *et al.* (2022) and reported FYM with inorganic fertilizer affect soil nutrient status in turmeric crop. This might be due to gradual and steady release of nutrient during the growth period as well as enhanced biological activity and proper nutrition to the crop.

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