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The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(9): 730-733

www.thepharmajournal.com
Received: 11-06-2022
Accepted: 13-07-2022

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Effect of integrated nutrient management on growth, yield and economics of coriander (*Coriandrum sativum* L.) under south Gujarat conditions

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Abstract
A field experiment was conducted at the College Farm, Navsari Agricultural University, Navsari (Gujarat) during *rabi* seasons of 2019-20 and 2020-21. There were nine treatments of integrated nutrient management *viz*., T_1-25% N through FYM + 75% RDN through inorganic fertilizer, T_2-FYM 5 t/ha + 100% RDN through inorganic fertilizer, T_3-25% N through Biocompost + 75% RDN through inorganic fertilizer, T_4-Biocompost 5 t/ha + 100% RDN through inorganic fertilizer, T_5-25% N through Vermicompost + 75% RDN through inorganic fertilizer, T_6-Vermicompost 5 t/ha + 100% RDN through inorganic fertilizer, T_7-FYM 5 t/ha, T_8-Biocompost 5 t/ha and T_9-Vermicompost 5 t/ha, were applied to coriander crop in *rabi* season (30 kg P_2O_5 were applied as basal dose in treatments T_1 to T_6) and replicated three times in randomized block design. Almost all the growth attributes, yield attributes and yield were significantly improved due to combination of organic manures and inorganics. Significantly higher seed yield and stover yield were observed under the treatment of Vermicompost 5 t/ha + 100% RDN through inorganic fertilizer (T_6) which remained at par with treatment of Biocompost 5 t/ha + 100% RDN through inorganic fertilizer (T_4). The highest net return ₹ 56157/ha with B:C ratio of 1.85 were recorded under the treatment of Biocompost 5 t/ha + 100% RDN through inorganic fertilizer (T_4) followed by 25% N through Biocompost + 75% RDN through inorganic fertilizer (T_3) and 25% N through Vermicompost + 75% RDN through inorganic fertilizer (T_5).

Keywords: Coriander, INM, FYM, vermicompost, bio compost, economics, South Gujarat

1. Introduction
Coriander (*Coriandrum sativum* L.) widely grown condiment crop of the tropics is very popular from cuisines to food court. It is an annual herbaceous plant which belongs to the family Apiaceae under the order Apiales and is native to the Mediterranean region. The name coriander was derived from the Greek word 'koris' and was given on accounts of its unpleasant odour of unripe green fruits. The name "cilantro" is frequently used in American English to refer to the green herb or the dried leaves of coriander. In India, coriander is locally known as Dhania. Coriander is extensively grown in India, Bangladesh, Russia, Central Europe and Morocco and it has been cultivated since human antiquity (Small, 1997 and Bhuiyan *et al*., 2009) [16, 2].

The stems, leaves and seeds of coriander are used in a number of culinary preparations. The green plant in India is used in soups, salads and chutneys. The seeds are also used as condiment; good quality oleoresin is extracted from coriander seeds. The oleoresin is used for flavouring beverage, pickles and sweets. Coriander contains an essential oil (0.03-2.60%). The essential oil of coriander is also called volatile oil. It has strong effects on the nervous system and is therefore widely used by aroma therapists and herbologists as a sedative, spasmolytic and local anaesthetic. It is also used against many skin complaints, mostly in the form of tea tree oil. The different parts of this plant contain monoterpenes, limonene, a-pinene, g-terpinene, p-cymene, citronellol, borneol, camphor, coriandrin, geraniol, dihydro-coriandrin, coriandrons A-E, flavonoids and essential oils (Farooq Anwar *et al*., 2011 and Nadeem *et al*., 2013) [6, 10].

India is the largest producer, consumer and exporter of coriander in the world and it is prominently grown in Rajasthan, Gujarat, Andhra Pradesh, Madhya Pradesh, Tamil Nadu, Orissa, Karnataka and Telangana. In India, coriander is cultivated in an area of 5.32 lakh ha with a production of 7.1 Mt with an average yield of 1.33 Mt/ha. Major producing states were Madhya Pradesh, Rajasthan and Gujarat. In Gujarat, 1.16 lakh Mt of coriander was produced in an area of 75 thousand ha in the year 2017-18. (Anonymous, 2018) [1].

The basic concept of integrated nutrient management (INM) is maintenance or adjustment of soil fertility and supply plant nutrients to an optimum level for sustaining the desired crop productivity through optimization of benefits from all possible sources of plant nutrients in an integrated manner (Tondon, 1992) [18]. Experiences from long term fertilizer experiments revealed that integrated use of farm yard manures, vermicompost, bio-compost, etc., with graded levels of chemical fertilizers is promising not only in maintaining higher productivity but also in providing maximum stability in crop production. The response of N as chemical fertilizer generally increases when it is used in combination with FYM, Vermicompost, etc. and saves N fertilizer (Nambiar and Abrol, 1989) [11].

2. Materials and methods

The present investigation was conducted during the *rabi* seasons of 2019-20 and 2020-21 at College Farm, Navsari Agricultural University, Navsari. It is situated in the South Gujarat Agro-climatic Zone. The soil of the experimental field was clayey in texture, low in organic carbon (0.49%) and available nitrogen (206.10kg/ha), medium in available phosphorus (32.30kg/ha) and high in available potassium (313.10kg/ha). The soil was slightly alkaline in reaction (pH 8.2) with normal electric conductivity (0.30 DS/m). There were nine treatments of integrated nutrient management *viz*., T_1-25% N through FYM + 75% RDN through inorganic fertilizer, T_2-FYM 5 t/ha + 100% RDN through inorganic fertilizer, T_3-25% N through Biocompost + 75% RDN through inorganic fertilizer, T_4-Biocompost 5 t/ha + 100% RDN through inorganic fertilizer, T_5-25% N through Vermicompost + 75% RDN through inorganic fertilizer, T_6-Vermicompost 5 t/ha + 100% RDN through inorganic fertilizer, T_7-FYM 5 t/ha, T_8-Biocompost 5 t/ha and T_9-Vermicompost 5 t/ha, were applied to coriander crop in *rabi* season and replicated three times in randomized block design. During both the years in treatments T_1 to T_6, 30kg P_2O_5/ha was applied. Coriander cv. GC 2 was sown with spacing of 30 × 10cm in November and harvested in March during both the years. The coriander crop was fertilized as per treatments. The nitrogen was applied through urea whereas phosphorus was applied through DAP. Organic manures (FYM, bio compost and vermicompost) were applied to coriander crop as per treatments and evenly spread and mixed in that particular plot. The data recorded during the course of investigation were subjected to statistical analysis as per method of analysis of variance (Panse and Sukhatme, 1978) [20].

3. Results and Discussion

3.1 Effect on growth attributes

Data presented in Table 1 indicate that different treatments of integrated nutrient management had a significant influence on growth attributes of coriander such as plant height and number of branches (primary and total). Significantly higher plant height at 60 DAS (46.48cm) and at harvest (100.12) as well as significantly higher number of primary branches (4.18) and total number of branches (15.75) of coriander was recorded under the treatment of Vermicompost 5 t/ha + 100% RDN through inorganic fertilizer (T_6) being at par with the treatment of Biocompost 5 t/ha + 100% RDN through inorganic fertilizer (T_4).

Higher plant height might be due to the application of nitrogen and phosphorus through chemical fertilizer which enhanced its availability which resulted in increased photosynthetic activity and translocation of photosynthates from source to sink which help towards higher plant height. At the same time effect of organic source (vermicompost) as a source of plant nutrient and humus improved the soil physiological conditions by increasing its capacity to absorb and store water, improving aeration and favoring the beneficial microbial activity which helps in improving plant height. The increase in plant height is also a function of cell division and cell enlargement, which depends upon availability of nutrients in balanced form especially N and P. the probable reason for more number of branches might be the combine application of organic as well as inorganic sources of nutrients to coriander. Application of recommended dose of fertilizer in form of inorganic fertilizer might have helped and enhanced the development of stronger cell walls and therefore stiffer branches which might resulted into profuse branches of coriander. Application of vermicompost might have helped in attaining a more balanced C:N ratio, abundant supply of available nutrients from soil with comparatively lesser retention in roots and more translocation to aerial parts for protoplasmic proteins and synthesis of other compounds. Similar findings were reported by Dhansi (2010) [4], Dadiga *et al*. (2015) [3], Kumar *et al*. (2015) [9] and Suman *et al*. (2018) [17].

Table 1: Effect of integrated nutrient management on periodical plant height, number of branches, umbels per plant, umbellates per umbels and seeds per umbellates of coriander (Pooled results)

Treatment	Plant height (cm)			No. of branches		Umbels/plant	Umbellate/Umbels	Seeds/umbellate
	30 DAS	60 DAS	At harvest	Primary	Total			
T_1	9.30	34.36	75.75	3.37	12.46	13.43	4.13	5.19
T_2	9.71	39.97	87.29	3.61	13.16	13.80	4.33	5.39
T_3	9.39	35.51	78.51	3.50	12.89	13.62	4.16	5.22
T_4	9.78	45.11	96.50	4.13	15.39	15.52	4.90	6.26
T_5	9.40	37.33	82.79	3.55	13.05	13.79	4.22	5.34
T_6	10.11	46.48	100.12	4.18	15.75	15.57	5.04	6.43
T_7	9.04	25.77	55.37	2.90	9.44	13.01	4.00	5.02
T_8	9.09	26.77	65.29	3.19	11.45	13.05	4.03	5.05
T_9	9.22	28.04	68.28	3.22	11.51	13.06	4.07	5.09
SEm±	0.07	0.48	1.29	0.02	0.14	0.02	0.03	0.06
CD (P=0.05)	NS	1.42	3.71	0.06	0.40	0.06	0.09	0.18
CV (%)	9.91	10.17	7.12	8.50	11.61	9.29	10.78	10.67
Interaction (Y x T)								
SEm±	0.07	2.56	3.97	0.21	1.05	0.91	0.33	0.41
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS

Table 2: Effect of integrated nutrient management on seed weight per plant, seed yield, and stover yield and harvest index of coriander (Pooled results)

Treatment	Seed weight/plant (g)	Seed yield (kg/ha)	Stover yield (kg/ha)	Harvest index (%)
T_1	3.85	1112	1883	37.24
T_2	4.44	1225	1887	39.41
T_3	3.95	1120	1885	37.30
T_4	5.88	1479	2174	40.50
T_5	4.25	1198	1886	38.83
T_6	5.96	1490	2180	40.59
T_7	3.60	904	1565	36.60
T_8	3.70	913	1584	36.62
T_9	3.73	1110	1590	41.13
SEm±	0.03	3.96	2.06	0.09
CD (P=0.05)	0.08	11.69	6.08	NS
CV (%)	10.12	11.14	11.37	9.55
Interaction (Y x T)				
SEm±	0.31	92.33	148.54	2.61
CD (P=0.05)	NS	NS	NS	NS

Table 3: Economics of coriander as influenced by different treatments (Average of 2019-20 and 2020-21)

Treatment	Yield (kg/ha)		Cost of cultivation (₹/ha)			Gross returns (₹/ha)	Net returns (₹/ha)	BCR
	Seed	Straw	Fixed	Treatment	Total			
T_1	1112	1883	23047	12261	35308	70759	35451	1.00
T_2	1225	1887	23047	17239	40286	73526	33241	0.83
T_3	1120	1885	23047	4552	27599	71005	43406	1.57
T_4	1479	2173	23047	7239	30286	86442	56157	1.85
T_5	1198	1886	23047	8993	32040	72878	40838	1.27
T_6	1490	2180	23047	32239	55286	87038	31752	0.57
T_7	904	1565	23047	15000	38047	58295	20248	0.53
T_8	913	1584	23047	5000	28047	58785	30738	1.10
T_9	1110	1590	23047	30000	53047	63855	10808	0.20

Selling price of grain (₹ 50 & 45/kg) and straw (₹ 0.50 & 0.50/kg) in 2019-20 and 2020-21, respectively

3.2 Effect on yield attributes and yield

Yield and yield attributes of coriander were also influenced significantly due to various treatments of integrated nutrient management (Table 2). Application of Vermicompost 5 t/ha + 100% RDN through inorganic fertilizer (T_6) recorded significantly higher number of umbels per plant (15.57), number of umbellates per umbel (5.04), number of seeds per umbellate (6.43), seed weight per plant (5.96g/plant), seed yield (1490kg/ha) and stover yield (2180kg/ha). A close observation on harvest index shows that the treatment effect was incapable to exercise a significant result on the harvest index of coriander.

More number of umbels per plant might be due to greater availability of photosynthates, metabolites and nutrients to develop reproductive structures which probably have resulted in higher number of umbels per plant. The higher number of umbellate per umbel under the combined application of inorganic and organic sources may be ascribed to the fact that application of adequate amount of inorganic fertilizer in the initial stage of growth resulted in survival of more number of flowers with high supply of photosynthates leading to more number of umbellates per umbel. Higher number of seeds per umbellate supplying of ample amount of nutrients in form of chemical fertilizer must have increased carbohydrate accumulation and their remobilization to reproductive parts of the plant, being closest sink and hence, resulted into increased flowering, fruiting and seed formation and thus more number of seeds per umbellate. The increase in seed weight per plant of coriander under the combined application of organic and inorganic sources of nutrients might be due to the fact that the same treatment registered higher number of umbels per plant and umbellate per umbel which ultimately resulted in higher seed yield per plant. The probable reason for higher seed yield of coriander maybe adequate supply of nutrient element at the right time from combined application of organic and inorganic sources which helped optimum dry matter partitioning from the source to sink during reproductive stage of plant and its effect on improved vegetative growth which ultimately lead to increase in photosynthetic activity of plant and root system and thus enabled 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 increase in straw yield is also a resultant effect of improved vegetative growth and better expression of growth attributes like plant height and number of branches. It might also be due to slow and steady supply of nutrients through combination of organic and inorganic fertilizer throughout the crop growth period which improved biomass production which resulted into higher straw yield. These results are in conformity with the results of Gajjar (2005) [7], Uddipta (2009) [19], Dhansi (2010) [4], Singh (2011) [15], Sanwal and Sharma (2017) [13], Singh *et al*. (2018) [14] and Suman *et al*. (2018) [17].

3.3 Effect on economics of coriander

On the basis of two year's average (2019-20 and 2020-21), maximum net returns of ₹ 56157/ha and BCR of 1.85 were recorded under the treatment of biocompost 5 t/ha + 100% RDN through inorganic fertilizer (T_4), followed by treatment of 25% N through biocompost + 75% RDN through inorganic fertilizer (T_3) (₹ 43406/ha) with BCR of 1.57 and treatment T_5 i.e. 25% N through vermicompost + 75% RDN through

inorganic fertilizer (₹ 40838/ha) and BCR of 1.27, while the lowest net return of ₹ 10808/ha was observed in treatment of vermicompost 5 t/ha (Table 3). The highest net returns and BCR under the treatment T_4 (bio compost 2.5 t/ha + 75% RDF) might be due to less cost of bio compost as compared to other organic manures used under study which resulted in low cost of cultivation coupled with higher grain yield turned in higher net returns and BCR. Similar results were also reported by Gajjar (2005) [7], Uddipta (2009) [19], Donga (2014) [21] and Jhankar *et al*. (2017) [8].

4. Conclusions

In the view of the results obtained from the present investigation, it can be concluded that for getting higher yield and net returns of coriander under south Gujarat condition, *rabi* coriander crop should be fertilized with Biocompost 5 t/ha + 100% RDN through inorganic fertilizer.

5. References

1. Anonymous. Horticultural statistics at a glance, 2018.
2. Bhuiyan N, Begum J, Sultana M. Chemical composition of leaf and seed essential oil of coriander (*Coriandrum sativum* L.) from Bangladesh. Bangladesh Journal of Pharmacology. 2009;4:150-153.
3. Dadiga A, Kadwey S, Sunil P. Influence of organic and inorganic sources of nutrients on growth, yield attributed traits and yield economic of coriander (*Coriandrum sativum* L.) *cv*. JD-1. Indian Journal of Agricultural Research. 2015;46(6):577-580.
4. Dhansi RY. Effect of integrated nitrogen management on soil properties and performance of coriander (*Coriandrum sativum* L.) in loamy sand soil. Thesis M.Sc., Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan, 2010.
5. Donga SJ, Chovatia PK, Verma HP, Rupareliya VV. Effect of organic manures and bio fertilizers on growth, yield and economics of coriander. New Series. 2017 June;38(2):226..
6. Farooq A, Muhammad S, Abdullah IH, Nazamid S, Shahid I, Umer R. Physicochemical composition of hydro-distilled essential oil from coriander (*Coriandrum sativum* L.) seeds cultivated in Pakistan. Journal of Medicinal Plants Research. 2011;5(15):3537-3544.
7. Gajjar MM. Response of coriander (*Coriandrum sativum* L.) to organic manure and fertilizer management under south Gujarat condition. Thesis M.Sc., Navsari Agricultural University, Navsari, Gujarat, 2005.
8. Jhankar P, Panda CM, Sethi D. Effect of INM practices on yield, yield attributes and economics of coriander (*Coriander sativum* L.). International Journal Current Microbiology Applied Sciences. 2017;6(5):1306-1312.
9. Kumar R, Singh MK, Kumar V, Verma RK, Kushwah JK, Pal M. Effect of nutrient supplementation through organic sources on growth, yield and quality of coriander (*Coriandrum sativum* L.). Indian journal of Agricultural Research. 2015;49(3):278-281.
10. Nadeem M, Faqir MA, Muhammad IK, Saima T, Ahmed El-Ghorab, Javed IS. Nutritional and medicinal aspects of coriander (*Coriandrum sativum* L.) A review. British Food Journal. 2013;115(5):743-755.
11. Nambiar KKM, Abrol IP. Long term fertilizer experiments in India-An overview. Fertil. News. 1989;34(4):11-20.
12. Panse VG, Sukhatme PV. Statistical methods for Agricultural workers, ICAR, New Delhi, 1967, 187-197.
13. Sanwal RC, Sharma Y. Impact of vermicompost, nitrogen and phosphorus on yield, quality and uptake of coriander (*Coriandrum sativum* L.) under arid condition. International Journal of Chemical Studies. 2017;5(6):1698-1702.
14. Singh H, Panghal VPS, Duhan DS. Irrigation and nutritional effect on growth and seed yield of coriander (*Coriandrum sativum* L.). Journal of Plant Nutrition. 2018;41(13):1705-1710.
15. Singh M. Effect of vermicompost and chemical fertilizers on growth, yield and quality of coriander (*Coriandrum sativum* L.) in semi-arid tropical climate. Journal of Species and Aromatic Crops. 2011;20(1):30-33.
16. Small E. "*Culinary herbs*", NRC Research Press, Ottawa, 1997, 219-225.
17. Suman P, Lakshminarayana D, Prasanth P, Naik S. Effect of Integrated Nutrient Management on Growth Parameters of Coriander (*Coriandrum sativum* L.) Cultivars under Telangana Conditions. International Journal Current Microbiology Applied Sciences. 2018;7(11):2871-2877.
18. Tondon HLS. (Ed). Fertilizers, organic manures, recyclable wastes and biofertilizers, Fertilizer Development and Consultation, New Delhi, 1992, 148.
19. Uddipta PS. Effect of integrated nutrient management on growth and yield of coriander (*Coriandrum sativum*) under middle Gujarat condition. Thesis M.Sc., Anand Agricultural University, Anand; c2009.
20. Panse VC, Sukhatme PV. Statistical methods for Agricultural workers. III Rev. Ed. ICAR, New Delhi, 1978.
21. Donga E, Romijn JA. Sleep characteristics and insulin sensitivity in humans. Handbook of Clinical Neurology. 2014 Jan 1;124:107-14.