The Pharma Innovation Journal 2022; 11(3): 1479-1482

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(3): 1479-1482

www.thepharmajournal.com
Received: 07-12-2021
Accepted: 15-01-2022

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Effect of organic and inorganic sources of nutrients on growth and yield of coriander (*Coriandrum sativum* L.)

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Abstract
The current study entitled "Effect of organic and inorganic sources of nutrients on growth, productivity and profitability of Coriander (*Coriandrum sativum* L.)" was carried out at Pt. Kishori Lal Shukla College of Horticulture and Research Station, Rajnandgaon Indira Gandhi Krishi Vishwavidyala (CG). During 2020-21. The experiment was comprised with eight treatments laid out in Randomized Block Design with three replication. The result revealed that the T_1 superior in growth attributes, T_6 superior in yield and yield attributes of coriander and gave the maximum seed yield (17.74 q./ha^{-1}) Followed by T_1 while minimum seed yield was recorded in control. Above result was due to differential response of nutrient combinations on growth of plant is due to the rapid availability of nutrients through chemical fertilizers application and organic manure which is found micronutrients helps in better absorption and subsequent utilization of nitrogen for synthesis of chlorophyll molecules, as nitrogen is an integral part of chlorophyll results in higher photosynthesis there by producing more photosynthates leading to more plant growth by exerting synergistic effect by organic and inorganic fertilizers.

Keywords: Organic, inorganic, nutrients, coriander, *Coriandrum sativum* L.

Introduction
Coriander is an important spice crop and grown all over the world is derived from the Greek word 'coris' which means 'bad bug' due to the unpleasant smell of unexpected green fruits (Dadiga *et al*., 2015) [3]. Coriander is an important Indian seed spice grown for both herbal and seed purposes. It belongs to the Apiaceae family (Lal *et al*., 2017) [5]. The green leaves are used in salads and are a good source of vitamins A and C. For this reason the young plants are used in the preparation of curries, chutneys, sauces and soups due to their aroma. The leaves and seeds are widely used as spices and flavor enhancers in foods around the world (Singh and Singh 1996).

Green seeds, as well as coriander of similar size and free from chemicals with physical impurities, are highly appreciated by the customer and their demand is high in the market with national and international prices. The contribution of various factors is to achieve a good yield quality with good properties; the handling of fertilizers is of great practical importance. The integrated fertilizer approach with organic compost and biofertilizers has proven to be promising enough not only to maintain high productivity, but also to ensure sustainable agricultural production (Tripathi *et al*., 2013) [11].

By using components to increase the yield, production, productivity and quality of this important coriander seed herb to increase the yield and quality capacity, there is a great improvement in growing high yielding coriander. It is reproducible. Therefore, studies were currently conducted to evaluate different genotypes for higher yields of fresh and dried herbs (Agasimani 2014) [1]. Coriander crops respond well to the use of organic fertilizers and inorganic fertilizers. Organic fertilizers provide important nutrients and micronutrients and improve soil health. Poor nutrition is the main factor behind poor performance and poor quality. Specific application of inorganic fertilizers has a detrimental effect on soil fertility due to one or more nutrient deficiencies, including micronutrients, resulting in decreased productivity, and insufficient supply of nutrients from one source may occur of nutrients for plants.

Methods and Materials
The present investigation was conducted during December 2020 to March 2021. The location of experiment site was at situated at Pt. KLS College of Horticulture and Research, Farm Bharregaon, Rajnandgaon, Indira Gandhi Krishi Vishwavidyalaya, Raipur (CG) with suitable services for water and canals available.

For the present investigation coriander variety Chhattisgarh Shri Chandrahasini Dhania-2 was used as experimental material. The field was divided into eight treatments *viz*., T_1: 100% RDF (Inorganic N: P: K. 60:40:30 kg ha^{-1}), T_2: 100% Vermi-compost @ 2.4 t ha^{-1}, T_3: 100% FYM@ 12 t ha^{-1}, T_4: 50% RDF + 50% Vermi-compost, T_5: 50% RDF + 50% FYM, T_6: 75% RDF + 25% Vermi-compost, T_7: 75% RDF + 25% FYM and T_8: Control with three replications using a randomized block design (RBD). The data obtained from the characters under study were analyzed by the method of analysis of variance as described by Panse and Sukhatme (1967).

Results and Discussion

Growth parameters

Plant height at 30, 60, DAS and at the harvest time

Plant height is one of the important growth character and a most important part of plant architecture. It is strongly associated with the maturity as well as yield of the day's period. Strong vegetative growth is an essential condition for high yield. The quick release of nitrogen made accessible to the plant is responsible for the get higher in plant height. It is a dependable indicator of growth and development representing the construction of infrastructure over some time. Table 1 showed plant heights measured at 30, 60, and days to at harvest time. Plant height grows as crop mature progress, according to the statistics.

At 30 days after the date of sowing and found the significantly effect of organic and inorganic fertilizers management was observed on plant height the applied treatments, T_1 (100% RDF) recorded maximum plant height (18.51 cm.) followed by the treatments T_6 (75% RDF + 25% Vermi-compost), T_4 (50% RDF+50%Vermi-compost) T_7 (75% RDF + 25% FYM) and T_5 (50% RDF+50%FYM). The treatment T_2 (100%Vermi-compost) and T_3 (100% FYM) statistically not different but superior than the treatment (10.92cm.) T_8 (Control).

At 60 days after the date of sowing and found the significantly effect of organic and inorganic fertilizers management was observed on plant height the applied treatments, T_1 (100% RDF) recorded maximum plant height (79.70 cm.) followed by the treatments T_6 (75% RDF+25%Vermi-compost) and T_7 (75% RDF+25% FYM) The treatment T_2 (100% Vermi-compost) and T_3 (100% FYM) T_4 (RDF 50% RDF+50%Vermi-compost) and 5 T_5 (50% RDF+50% FYM) statistically not different but superior than the treatment (61.87cm) T_8 (Control).

At harvest time found the significantly effect of organic and inorganic fertilizers management was observed on plant height the applied treatments, T_1 (100% RDF), recorded maximum plant height (144.24cm.) followed by the treatments T_6 (75% RDF + 25% Vermi-compost), T_4 (50% RDF+50%Vermi-compost) T_7 (75% RDF + 25% FYM), and T_5 (50% RDF+50%FYM) The treatment T_2 (100%Vermi-compost) and T_3 (100% FYM) statistically not different but superior than the treatment (122.64cm.) T_8 (Control).

It is assumed that this is an increase in nutrients by Inorganic (N:P:K) fertilizers; with solubilization of P and K must have made the nutrients available in better quantity than the take a break of the corresponding treatments. The higher level of nutrients available under T_1 may be due to the application of an optimal amount of fortified synthetic fertilizers which provide a sufficient amount of with good grace available nutrients to the soil. The beneficial effect of fertilization levels on coriander growth is well documented by Singh *et al* (2000) [9].

Numbers of primary branches plant^{-1} at 30 and 60 Days

Analysis of data pertaining to numbers of primary branches plant^{-1} at 30 and 60 Days was observed and presented in Table 2.

A 30 days crop growth stages number of primary branches plant^{-1} significantly effect of organic and inorganic fertilizers management was observed on numbers of primary branches plant^{-1}. Among the applied treatments, T_1 (100% RDF) recorded more primary branches plant^{-1} (2.70) at par with the treatments T_6 (75% RDF+25%Vermi-compost), T_7 (75% RDF+25% FYM), T_4 (RDF 50% RDF+50%Vermi-compost) and T_5 (50% RDF+50% FYM). Followed by The treatment T_2 (100% Vermi-compost) and T_3 (100% FYM) statistically not different but superior than the treatment (0.80) T_8 (Control).

A 60 days crop growth stages number of primary branches plant^{-1} significantly effect of organic and inorganic fertilizers management was observed on numbers of primary branches plant^{-1}. Among the applied treatments, T_1 (100% RDF) recorded more primary branches plant^{-1} (7.53) at par with the treatments T_6 (75% RDF+25%Vermi-compost), T_7 (75% RDF+25% FYM), T_4 (RDF 50% RDF+50%Vermi-compost) and T_5 (50% RDF+50% FYM). The treatment T_2 (100% Vermi-compost) and T_3 (100% FYM) statistically not different but superior than the treatment (4.53) T_8 (Control).

Using inorganic fertilizers increases the nitrogen content and rate of photosynthesis, which is consistent with the primary branches plant^{-1} (Migahed *et al*., 2004; Choudhary *et al*., 2004). In coriander, Hnamte *et al*., (2013) [4] found that combination of organic and inorganic fertilizers enhanced the number of primary branches plant^{-1}. Suman *et al*. (2018) [10] report similar results.

Numbers of secondary branches plant^{-1} at 60 and 90 Days

Analysis of data pertaining to numbers of secondary branches plant^{-1} at 60 and 90 DAS was observed and presented in Table 2.

At 60 days crop growth stages Secondary number of branches plant^{-1} effect significantly of organic and inorganic fertilizers management was observed on numbers of Secondary branches plant^{-1}. Among the applied treatments, T_6 (75% RDF+25% Vermi-compost) recorded more Secondary branches plant^{-1} (14.20) followed by the treatments T_1 (100% RDF), T_7 (75% RDF+25% FYM) and T_4 (50% RDF+50% Vermi-compost). The treatment T_2 (100% Vermi-compost), T_3 (100% FYM) and T_5 (50% RDF+50% FYM) statistically not different but superior than the treatment (8.90) T_8 (Control).

A 90 days number of Secondary branches plant^{-1}significantly effect of inorganic and organic fertilizers management was observed on Secondary numbers of branches plant^{-1}. Among the applied treatments, (T_6) 75% RDF+25%Vermi-compost recorded more Secondary branches plant^{-1}(22.43) followed by the treatments T_1 (100% RDF), T_7 (75% RDF+25% FYM) and T_4 (RDF 50% RDF+50%Vermi-compost) The treatment T_2 (100% Vermi-compost) and T_3 (100% FYM) and 50% RDF+50% FYM (T_5) statistically not different but superior than the treatment (8.90) T_8 (Control).

More secondary branches plant^{-1} were produced as a result of increased plant height, which resulted in more photosynthetic

activity, which led to the secondary development of more branches per plant. In coriander, Sahu *et al*., (2014) reported that treatment with Inorganic fertilizers and organic manures resulted in a higher secondary number of branches plant^{-1}. Suman *et al*. (2018) [10] reported a similar result.

Number of Umbels plant^{-1}

The integrated effect of inorganic and organic fertilizers management was observed on numbers of umbels plant^{-1}. Observation on numbers of umbellate umbels^{-1} was statistically analyzed & presented in Table 3.

A number of Umbels plant^{-1} significantly Effect of organic and inorganic fertilizers management was observed on numbers of Umbels plant^{-1}. Among the applied treatments, T_6 (75% RDF+25%Vermi-compost) recorded more numbers of Umbels plant^{-1} (74.53) at par with the treatments T_1 (100% RDF), T_7 75% RDF + 25% FYM), and found minimum number of umbels plant^{-1} that the treatment (59.04) T_8 (Control).

The maximum umbels number of plant^{-1} might be attributable to lush vegetative development, a higher branches number of plant^{-1}, Number of umbels plant^{-1} and a shorter time to 50% flowering. Similar result reported by Suman *et al*., (2018) [10].

Number of umbellate Umbel^{-1}

The recorded of data (Table 3) umbellate plant^{-1} significantly in different treatments. The maximum numbers of umbellate Umbel^{-1} (6.60) were observed in **T_6** (75% RDF + 25%Vermi-compost) recorded more umbellate Umbel^{-1} (6.6) follow the treatments **T_7** (75% RDF + 25% FYM), T_1 (100% RDF). Minimum results fined the treatment (4.90) **T_8** (Control).

The highest number of umbellate umbel^{-1} was owing to the fact that there was more umbellate plant-1than in the other fertilizer levels. (Antibiotics, growth hormones and enzymes) are available in Vermi-compost it may be factor for best resulting this character in coriander. Identical outcomes were also reported by Tripathi *et al*., (2013) [11], Mounika *et al*., (2018) [7] and Suman *et al*., (2018) [10] in coriander.

Days to first Flowering

The effect of inorganic and organic fertilizers management was observed on Days to first Flowering. Observation on Days to number of first Flowering was statistically analyzed & presented in Table 3.

Among the applied treatments number of Days to first Flowering significantly effect of organic and inorganic nutrients was observed on among the applied treatments, recorded minimum days to first flowering (49.66 days) **T_8** (Control). at par with the treatments T_7 (75% RDF +25%FYM). **T_6** (75% RDF +25%Vermi-compost) recorded maximum day to first Flowering (61.00 days).

Indicating that supplementing inorganic fertilizers with organic source which improved the general soil environment, physicochemical and biological conditions, helped in improving the coriander N and P are the 2 major essential nutrients for growth and superior production or yield character of coriander. Frequent Nitrogen fertilizers application of is likely to increase the absorption of nitrate in soil water which is harmful to human health (Elasbah and Tripathi *et al*., 2019).

Days to 50% flowering

The integrated management of nutrient had non-significant effect on the days to 50% flowering. Observation on 50% flowering in days was statistically analyzed & presented in Table 3.

Observed on among the applied treatments, recorded minimum days to 50% flowering (65.00 days) **T_8** (Control). at par with the treatments T_7 (75% RDF +25%FYM). **T_6** (75% RDF +25%Vermi-compost) recorded maximum day to 50% Flowering (66.66 days).

Yield Parameters

Number of seeds umbels^{-1}

The data recorded towards the number of seeds umbel^{-1} as influenced by different levels of inorganic and organic fertilizer has been given in Table 4.

The number of seeds umbel^{-1} was influenced significantly by different level of organic manures. T_6 (75% RDF+25% Vermi-compost) produced the highest number of seeds umbel^{-1} (45.18) followed by T_1 (100% RDF), T_7 (75% RDF+25% FYM), and T_4 (50% RDF+50% Vermi-compost). Which were comparable to one another, although at the minimum number of seeds umbel^{-1} (33.60) was noted in T_8 (Control). The treatment T_2 (100% Vermi-compost) and T_3 (100% FYM) and T_5 (50% RDF+50% FYM) statistically not different but superior to the treatment T_8 (Control).

Number of seeds per umbel^{-1} was significantly influenced about fertilizer levels. A richest nutrient available in the Vermi-compost is like O, C, N, P, K, Ca, Cu, Zn, Fe, Mg, Br and Mn when compare to farmyard manure. It might be due to more number of seeds umbel^{-1}, umbels plant^{-1}, umbellate umbel^{-1} and maximum 1000 seed test weight influence of this fertilizer level treatment over the others. This type effect were in accordance with that of the Tripathi *et al*., (2013) [11] and Suman *et al*, (2018) [10] in coriander who reported that integrated nutrient management practice improved the growth and yield causal character. Similarly findings are in line with the Mounika *et al*., (2018) [7].

Test weight 1000^{-1} seeds

The data are presented in Table 4 showed significant differences among the seed. Although the higher seed index (13.03 g) was recorded in T_6 (75% RDF+25% Vermi-compost) followed by T_7 (75% RDF+25% FYM) and T_5 (50% RDF+50% FYM) which were at par with each other. Minimum seedtest weight (9.80 g) was recorded by treatment T_8 (Control).

A richest nutrient available in the Vermi-compost is like O, C, N, P, K, Ca, Cu, Zn, Fe, Mg, Br and Mn when compare to farmyard manure. Organic fertilizers contain nitrogen rich resources, high extractable nutrients (P, K, Ca, MG, Cu, Zn,) and can significantly raise soil fertility in the medium to long term. It might be due to higher photosynthates accumulation in seed by application of Organic with inorganic fertilizers (Labeta *et al.* 2019).

Seed yield gram plant^{-1}

The effect of organic and inorganic fertilizers management was observed on the seed yield gram plant^{-1} observation on the weight of seed yield gram plant^{-1} was statistically analyzed and presented in Table 4.

Among the applied treatments, T_6 (75% RDF+25% Vermi-compost) recommended dose of fertilizers 60:40:30 kilogram hectare^{-1} N:P:K recorded significantly higher seed yield gram plant^{-1} (4.43gram.) over other treatments in comparison.

However, it was at par with treatment T_1 (100% RDF). The significantly lowest seed yield gram plant^{-1} (2.38gram) was observed in treatment T_8 (control).

It might be due to more number of umbels plant^{-1}, umbellate umbel^{-1}, seeds umbel^{-1} and maximum 1000 seed test weight of this fertilizer level treatment over the others. These results were in accordance with that of Tripathi *et al*., (2013) [11] and Suman *et al*, (2018) [10] in coriander who reported that integrated nutrient management practice improved the growth and yield contributing characters. Similarly findings are in line with the Mounika *et al*., (2018) [7] He claimed that balanced fertilizer application increased the availability of phosphorus, nitrogen, and other nutrients, as well as yield contributing factors.

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

The effect of organic and inorganic fertilizers management was observed on the seed yield ha^{-1} observation on the weight of seed yield ha^{-1} was statistically analyzed & presented in Table 4.

The data presented in Table 4 showed maximum seed yield (17.74 q ha^{-1}) in treatment T_6 (75% RDF+25%Vermi-compost) which was at par with T_7 (75% RDF+25% FYM), T_1 (100% RDF), T_4 (50% RDF+50% Vermi-compost) and T_5 (50% RDF+50% FYM). Significantly superior over T_2 100% (Vermi-compost), T_3 (100% FYM) T_8 (Control) was minimum seed yield recorded at (9.51 q. ha^{-1}).

It might be due maximum seed yield plant^{-1} of this fertilizer level treatment over the others. Similarly findings are in line with the Mounika *et al*., (2018) [7] he claimed that balanced fertilizer application increased the availability of nitrogen, phosphorus, and other nutrients, resulting in higher yield attributing characteristics. A similar results was also recorded by Suman *et al*., (2019), Pooja *et al*., (2017) and Nisarata *et al*., (2020) [8]. Pooja *et al*., (2017) in coriander, who found that practicing of integrated nutrient management improved the nutrient uptake, photosynthesis activity and moreover resistant to pests and diseases, finally result found in high seed yield. (Antibiotics, growth hormones and enzymes) are available in Vermi-compost it may be factor for gave the best results this in the coriander (Vadiraj *et al*. 1998).

Conclusion

It was concluded from the result that the T_1 superior in growth attributes, T_6 superior in yield and yield attributes of coriander and gave the maximum seed yield (17.74 q./ha^{-1}) Followed by T_1 while minimum seed yield was recorded in control. Above result was due to differential response of nutrient combinations on growth of plant is due to the rapid availability of nutrients through chemical fertilizers application and organic manure which is found micronutrients helps in better absorption and subsequent utilization of nitrogen for synthesis of chlorophyll molecules, as nitrogen is an integral part of chlorophyll results in higher photosynthesis there by producing more photosynthates leading to more plant growth by exerting synergistic effect by organic and inorganic fertilizers.

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