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Influence of organic and inorganic sources of nutrients on N and P content and uptake from seed and stover of coriander (*Coriandrum sativum* L.)

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Abstract
A field experiment on "Influence of organic and inorganic sources of nutrients on growth and yield of coriander (*Coriandrum sativum* L.)" was conducted at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during *rabi* 2019-20 on loamy sand soil. Twelve treatment combinations comprising of three levels of inorganic fertilizer (100, 75 and 50% RDF), two sources of organic manure (FYM @ 5 t/ha and Castor cake @ 0.5 t/ha) and two levels of biofertilizer with biofertilizer *Azotobacter* @ 5 ml/kg seed and without biofertilizer were laid out in randomized block design (factorial) with three replications.
The results revealed that the inorganic and organic sources significantly increased N & P content and uptake (seed and stover). An application of 100% RDF as well as castor cake @ 0.5 t/ha they gave highest net return and BCR. Significantly improved N & P content and uptake (seed and stover), net return and BCR due to *Azotobacter* @ 5 ml/kg seed.

Keywords: coriander, nitrogen, phosphorus, content, uptake

Introduction
Coriander (*Coriandrum sativum* L.) is one of the most important spice crop belongs to *Apiaceae* family. It is commonly known as "Dhania" or "Dhana". Nitrogen has a considerable effect, not only on quality of produce but on quantity of produce also. Nitrogen is one of the major element for growth and development of plant. It is involved in photosynthesis, respiration and protein synthesis. It impart the dark green colour of the leaves, promotes vigorous vegetative growth and more efficient use of available inputs finally leads to higher productivity.
Inadequate and imbalanced application of nutrient is one of major factor for low yield and poor quality. Exclusive application of organic fertilizer creates deleterious effect on soil fertility due to limitation of one or more nutrients including micro nutrients and poor soil health leading to decline in productivity. No single source of nutrient is capable of supplying plant nutrient in adequate amount and balanced proportion. The conjunctive application of organics with inorganic sources of nutrients reduces the dependence on chemical inputs and it not only acts as a source of nutrients but also provides micro nutrients as well as modifies the soil physical behaviour and increases the efficiency of applied nutrients.
Among the primary nutrients, nitrogen is one of the most important element as well as expensive input in agriculture. It has a considerable effect on quantity as well as quality. An adequate supply of nitrogen is closely associated with growth and development of plant. Nitrogen also increases the competitive ability of the crop. It is well-established fact that for exploiting the yield potential for high yielding varieties, higher doses of fertilizer is to be required. Coriander also variedly responds well to the application of manures and fertilizers depending on the climatic conditions and soil types. Nitrogen, phosphorus and potassium markedly influence the growth and development of plants. Besides calcium, magnesium and sulphur also have been found to influence the growth and yield of coriander. However, modern and intensive agriculture necessarily depends on heavy consumption of fertilizers and chemicals, which cause the pollution and environmental hazards. Besides, neglecting the traditional good practices.

Materials and Methods

A field experiment was conducted at the Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during *rabi* season of the year 2019-20.

Geographically, Sardarkrushinagar is situated at 24°-19' N latitude and 72°-19' E longitude with an altitude of 154.52 meter above the mean sea level. It is located in the North Gujarat Agro-climatic Zone. The soil of the experimental plot was loamy sand in texture and slightly alkaline in reaction. The soil was low in organic carbon (0.23%), available nitrogen (158.0 kg/ha) and medium in available phosphorus (37.9 kg/ha) and high in available potassium (286.0 kg/ha) with soil pH of 7.42. Twelve treatment combinations comprising of three levels of inorganic fertilizer (100, 75 and 50% RDF), two sources of organic manure (FYM @ 5 t/ha and Castor cake @ 0.5 t/ha) and two levels of biofertilizer with biofertilizer *Azotobacter* @ 5 ml/kg seed and without biofertilizer were laid out in randomized block design (factorial) with three replications. The crop coriander and variety 'Gujarat coriander 3' were sown on 16th November, 2019 with recommended seed rate of 15 kg/ha by maintaining 30 cm distance between rows. The seeds were sown manually at the depth of 5 cm in previously opened furrows and covered properly with soil. The experimental plots were fertilized as per treatments. Inorganic fertilizer levels, Sources of organic manure and levels of biofertilizer were applied as per the treatments. The total quantity of urea and DAP as per treatments were applied in previously opened furrow at the time of sowing (From urea containing 46% N and DAP containing 46% P_2O_5, 18% N). The required quantity of FYM and castor cake worked out and applied at the time of sowing as per treatments. The seeds were treated uniformly with *Azotobacter* was worked out and applied as seed treatment and allowed to dry in the shade. After drying, the seeds were sown immediately.

Results and Discussion

Effect of inorganic fertilizer

The results revealed that nitrogen content in seed and stover of coriander was significantly affected by different levels of inorganic fertilizer. Application of (100% RDF) F_1 recorded significantly higher nitrogen content in seed (3.13%) and stover (0.686%) but it was remained at par with F_2 (75% RDF). The nitrogen content in seed and stover of coriander were relatively higher with increasing level of nitrogen. Since the concentration of nitrogen and dry matter production increased with nitrogen application, the uptake of nutrient also increases. The higher percentage of nitrogen was recorded in seed. It is because of the ability of nitrogen to more towards reproductive organs. Since most of nutrients (N, P and S) in seed is relocated from their reserves in vegetative parts, better nutritional conditions of soil with balanced fertilization seems to be on account of their higher concentration in plants. These results are close conformity with the findings of Javiya *et al.* (2017) [1] in coriander and Rana *et al.* (2012) [2] in black cumin.

Data given in Table 1 revealed that different levels of inorganic fertilizer significantly influenced the phosphorus content in seed and stover of coriander. The significantly higher phosphorus content in seed and stover (0.57 and 0.187% observed in treatment F_1 (100% RDF). Significant improvement in content of phosphorus might be attributed to the respective higher concentration in seed and stover and associated with higher seed and stover yield. The added phosphorus resulted in increased availability of available phosphorus under proper environmental condition of plant growth. The results of present investigation are in close conformity with the findings of Javiya *et al.* (2017) [1] in coriander and Mehta *et al.* (2012^b) [4] in fenugreek.

Nitrogen uptake by seed and stover of coriander was significantly affected by different levels of inorganic fertilizer. Application of 100% of RDF (F_1) recorded significantly higher nitrogen uptake 29.91 and 9.510 kg/ha by seed and stover. Increase in uptake of N, P and K by crop with 20 kg N/ ha might be attributed to cumulative effect of increased yield and comparatively higher content of N, P and K in seed and straw. Nitrogen fertilization resulted in larger accumulation of nutrient from a fast growing root system. These results are in close conformity with the results of Patel *et al.* (2013^a) [6], Sanwal *et al.* (2017) [10] in coriander and Patel *et al.* (2013^b) [7] in cumin.

An appraisal of data exhibited in Table 4.10 indicated that phosphorus uptake by seed and stover of coriander were significantly affected by different levels of inorganic fertilizer. Application of 100% of RDF (F_1) recorded significantly higher nitrogen uptake 5.48 and 2.586 kg/ha by seed and stover. The considerable increase in P uptake by seed and stover could be attributed to the fact that P stimulates the early root development and growth and thereby efficient utilization of nutrients from the deeper soil layer. A significant influence on these nutrient uptake by seed and straw due to increase in concentration along with increase in yield of seed and stover. These results are accordance with the findings of Sanwal *et al.* (2017) [10] in coriander and Ali *et al.* (2009) [2], Mehta *et al.* (2011^b) [5], Mehta *et al.* (2012^b) [4] in fenugreek.

Effect of organic manure

The results revealed that the effect different sources of organic manure differ significantly with respect to nitrogen content in seed and stover. Significantly higher nitrogen content in seed and stover (2.95 and 0.605%) was recorded with the application of Castor cake @ 0.5 t/ha. Nitrogen from leaf tissue might have been translocated and utilized for formation of flowers. This might be the reason for observed descend in nitrogen content at these stages. Hormone application causes increase in physiological and metabolic activities of plant as a result of which there might be more uptakes of plant nutrients from soil. These results are in close conformity with the findings of Ravimycin (2016) [9] in coriander.

The effect of different sources of organic manure differ significantly with respect to phosphorus content in seed and stover. Significantly maximum phosphorus content in seed and stover (0.55 and 0.172%) was recorded with the application of Castor cake @ 0.5 t/ha.

The results revealed that application of castor cake @ 0.5 t/ha recorded significantly higher nitrogen uptake by seed and stover (26.96 and 7.922 kg/ha). This might due to increased dry matter at different growth stages and biological yield of coriander at harvest coupled with higher nutrient contents due to application of vermicompost lead to higher N uptake by coriander. The results obtained are in close conformity with the findings of Sanwal *et al.* (2017) [10] in coriander.

Data given in Table 1 revealed that the effect different sources of organic manure differ significantly with respect to phosphorus uptake by seed and stover. Significantly higher

phosphorus uptake by seed and stover (4.99 and 2.246 kg/ha) was recorded with the application of Castor cake @ 0.5 t/ha.

Effect of biofertilizer

The results revealed that significantly higher nitrogen content in seed (2.97%) and stover (0.608%) were noted with biofertilizer *Azotobacter* @ 5 ml/ kg seed (B_1). This might be due to the fact that *Azotobacter* inoculation increased root through better root development, nodulation, more nutrient availability resulting in more nutrient in plant system leading to higher N content in seed and stover. These results are in close conformity with findings of Mehta *et al.* (2012^b) [4] in fenugreek.

A perusal of data furnished in Table 1 indicated that seeds treated with *Azotobacter* @ 5 ml/kg seed (B_1) recorded significantly higher phosphorus content in seed and stover (0.54 and 0. 171%). This might be due to seed inoculation with *Azotobacter* which mobilizes unavailable phosphorus in to available form as well as protecting fixation of added phosphate and rendered more available P for absorption by plant roots. These findings corroborated the results of Mehta *et al.* (2012^b) [4] in fenugreek.

The data summarized in Table 1 revealed that treatment B_1 (seed inoculation with *Azotobacter* @ 5 ml/kg seed) noted significantly higher nitrogen uptake by seed (27.34 kg/ha) and stover (8.444 kg/ha). This might be due to the fact that *Azotobacter* inoculation increased root through better root development, nodulation, more nutrient availability resulting in more nutrient in plant system leading to higher N, P and K uptake. These results are in close conformity with findings of Mehta *et al*. (2011^a) [3] in coriander and Ali *et al*. (2009) [2], Mehta *et al*. (2012^b) [4] in fenugreek.

Data presented in Table 1 revealed that treatment B_1 (with biofertilizer *Azotobacter* @ 5 ml/kg seed) noted significantly higher phosphorus uptake by seed (4.99 kg/ha) and stover (2.370 kg/ha). Results are corroborated with the findings of Mehta *et al*. (2011^a) [3] in coriander.

Table 1: Effect of inorganic and organic nutrients on N and P content and uptake from seed and stover of coriander (*Coriandrum sativum* L.)

Treatments	N content (%)		P content (%)		N uptake (kg/ha)		P uptake (kg/ha)	
	Seed	Stover	Seed	Stover	Seed	Stover	Seed	Stover
Levels of inorganic fertilizer (F)								
F_1 - 100 % RDF	3.13	0.686	0.57	0.187	29.91	9.51	5.48	2.58
F_2 - 75 % RDF	3.06	0.586	0.53	0.167	27.29	7.35	4.75	2.09
F_3 - 50 % RDF	2.56	0.496	0.50	0.147	20.37	5.55	4.01	1.63
S.Em ±	0.03	0.010	0.006	0.0022	0.75	0.28	0.13	0.06
CD at 5%	0.09	0.030	0.02	0.0063	2.20	0.83	0.39	0.20
Sources of organic manure (O)								
O_1 - FYM @ 5 t/ha	2.88	0.574	0.53	0.162	24.75	7.02	4.51	1.96
O_2 - Castor cake @ 0.5 t/ha	2.95	0.605	0.55	0.172	26.96	7.92	4.99	2.24
S.Em ±	0.03	0.008	0.005	0.0018	0.61	0.23	0.11	0.05
CD at 5%	0.07	0.025	0.01	0.0052	1.80	0.68	0.32	0.16
Levels of biofertilizer (B)								
B_1 - With biofertilizer	2.97	0.608	0.54	0.171	27.34	8.44	4.99	2.37
B_2 - Without biofertilizer	2.86	0.571	0.53	0.163	24.38	6.50	4.50	1.84
S.Em ±	0.03	0.008	0.005	0.0018	0.61	0.23	0.11	0.05
CD at 5%	0.07	0.025	0.01	0.0052	1.80	0.68	0.32	0.16
Interactions	NS	NS	NS	NS	NS	NS	NS	NS
CV (%)	3.71	6.08	3.93	4.47	10.04	13.22	9.73	11.37

Interaction effect

The interaction effect of inorganic fertilizer levels, sources of organic manure and levels of biofertilizer was not found significant on growth attributes, yield, yield attributes, quality parameter.

Conclusion

It is concluded that coriander should be fertilized with 75% of RDF (15-7.5-00 kg N:P:K/ha), seed inoculation with *Azotobacter* @ 5 ml/kg seed and soil application of either FYM @ 5 t/ha or castor cake @ 0.5 t/ha for obtaining higher yield and economic return.

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