Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.5183

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (4):** 860-866 (2017)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Response of Coriander (*Coriandrum sativum* L.) to Nitrogen and Phosphorus in South Saurashtra Condition

P. P. Javiya*, J. N. Solanki, S. C. Kaneria and V. V. Rupareliya

Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh – 362 001

*Corresponding Author E-mail: pratikjaviya1991@gmail.com

Received: 10.07.2017 | Revised: 18.07.2017 | Accepted: 19.07.2017

ABSTRACT

A field experiment was conducted during rabi season of 2014-15 on clayey soil at Junagadh to study the "Response of coriander (coriandrum sativum l.) to nitrogen and phosphorus in south saurashtra condition". The experiment comprising of 16 treatment combinations with four levels of nitrogen viz., 0, 20, 40 and 60 kg N/ha and four levels of phosphorus viz., 0, 20, 40 and 60 kg P_2O_5/ha was laid out in Factorial Randomized Block Design with three replications. The experiment results revealed that the 60 kg N/ha promoted growth parameters viz., plant height, plant spread, number of branches per plant; yield attributes viz., number of umbels per plant, number of umbellates per umbel, number of seeds per umbellate, weight of seed per plant, test weight, ultimately higher seed yield (1483 kg/ha) and stover yield (1760 kg/ha), with higher net return (₹65976/ha) and B:C ratio (3.48) over the control (N_1). Application of phosphorus enhanced significantly growth parameters viz., plant height, plant spread, number of branches per plant; yield attributes viz., number of umbels per plant, number of umbellates per umbel, number of seeds per umbellate, weight of seeds per plant, 1000 seed weight higher seed yield (1388 kg/ha) and stover yield (1613 kg/ha), of coriander upto 40 kg P_2O_5/ha, the yield further increased with increasing level of P_2O_5 but could not reach upto level of significant. The maximum net realization of (₹61008/ha) obtained with 60 kg P_2O_5/ha, but B:C ratio maximum (3.26) was obtained with 40 kg P_2O_5/ha. It also significantly increased content and uptake of NPK kg/ha at 60 kg N/ha and 60 kg P_2O_5/ha in seed and stover.

Key words: *Coriander, Economics, Growth and Yield, Nitrogen, Nutrients content and uptake, Phosphorus.*

INTRODUCTION

India is the world's largest producers, consumers and exporter of seed spices. There are about 20 seed spices grown in India and among them cumin, fennel, coriander, fenugreek, dill seed, ajwain *etc.* are vital *rabi* seed spices for arid and semi arid regions of the country. Gujarat and Rajasthan together contribute more than 80 per cent of the total seed spices production in the country and thus, both the states together are known as "seed spices bowl" of India.

Cite this article: Javiya, P.P., Solanki, J.N., Kaneria, S.C. and Rupareliya, V.V., Response of Coriander (*Coriandrum sativum* L.) to Nitrogen and Phosphorus in South Saurashtra Condition, *Int. J. Pure App. Biosci.* **5(4):** 860-866 (2017). doi: http://dx.doi.org/10.18782/2320-7051.5183

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.

Deficiency of nitrogen cause yellowish of lower leaves, stunted plant growth and shadings of leaves as well as fruits might be responsible for poor yield[26]. Whereas, excess application of nitrogen is responsible for luxurious shoot growth which makes plant more susceptible to pest and diseases, poor root growth cause lodging and delay the crop maturity thus, it reduce the crop yield and quality of produce[18].

Phosphorus plays a pivotal structure and regulatory role at the nexus of photosynthesis, root development, energy conservation and transformation, carbon metabolism, redox reactions, enzyme activation signalling and nucleic acid synthesis[24]. It also has a significant role in sustaining and building up soil fertility, particularly under intensive systems of agriculture, but it is one of the most immobile, inaccessible and unavailable nutrient present in the soil[22]. Phosphorus fertilization increased the vegetative growth, essential oil, fixed oil, total carbohydrates, soluble sugars and NPK content of some Apiaceae (Anis, Coriander and Sweet fennel)[9].

High yielding coriander varieties are very specific in their nutritional requirement and also need very judicious use of fertilizer to exploit their genetic yield potential, boosting up fertilizer use efficiency and large scale adoption in under developed regions, whereas, farmers have limited capital resources.

MATERIALS AND METHODS

The field experiment was conducted at Instructional Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh during *rabi* 2014-2015. The investigation was carried out in Factorial Randomized Block Design with three replications and the experiment consisted four levels of nitrogen i.e. N_1 (0 kg N/ha), N_2 (20 kg N/ha), N_3 (40 kg N/ha) and N_4 (60 kg N/ha) and four levels of phosphorus *viz*., P_1 (0 kg P_2O_5/ha), P_2 (20 kg P_2O_5/ha), P3 (40 kg P_2O_5/ha) and P_4 (60 kg P_2O_5/ha). Coriander variety Gujarat Coriander-2 was sown at 30 cm row spacing. Entire dose of phosphorus as per treatments was applied at sowing and dose of nitrogen as per treatments was applied in two split (1^{st} at sowing and 2^{nd} at 30 DAS). Nitrogen and phosphorus were applied in the form of Urea and SSP, respectively. All the recommended cultural and plant protection measures were followed throughout the experimentation. Irrigation to 5 cm depth applied during cropping period. Five random plants were selected from each plot excluding the border row for taking observation on growth and yield attributes. The data were subjected to statistical analysis by adopting appropriate analysis of variance as described by Cochran and Cox[4].

RESULTS AND DISCUSSION

Effect of nitrogen

Growth, Yield attributes and Yield

The data presented in (Table 1) revealed that nitrogen level (N_4) 60 kg N/ha recorded significantly higher plant height (10.74 cm, 58.01 cm and 65.44 cm at 30, 60 DAS and at harvest, respectively), plant spread (8.85 cm, 18.21 cm and 19.60 cm at 30, 60 DAS and at harvest, respectively), number of branches per plant (28.56), whereas (Table 2) number of umbels per plant (14.31), number of umbellates per umbel (4.86), number of seeds per umbel (5.67), seed weight per plant (5.46 g) and 1000 seed weight (14.78 g). Also recorded seed and stover yield of 1483 kg/ha and 1760 kg/ha at 60 kg N/ha (N_4). Whereas, significantly the lowest values was observed

under treatment N_1 (control). Nitrogen is considered to be a vitally important plant nutrient. In addition to its role in the formation of proteins, nitrogen is an integral part of chlorophyll which is the primary absorber of light energy needed for photosynthesis. Besides these, it is also a constituent of certain organic compounds of physiological importance[3]. The growth coupled with batter expression of yield attributes might have attributed for enhancing the seed yield under higher nitrogen level. These results are in close conformity with the finding of Bedse *et al*.[1], Moosavi *et al*.[11], Nowak and Szempliński[14] and Patel *et al*[15].

Nutrient content and uptake by seed and stover of coriander

An examination of data (Table 3) showed that the application of nitrogen @ 60 kg/ha (N_4) recorded significantly higher higher nitrogen content in seed (2.56 %) and stover (1.42 %) but different levels of nitrogen do not exerted their significant influence on phosphorus and potassium content in seed and stover., whereas in (Table 4) recorded significantly higher uptake of nitrogen by seed (37.98 kg/ha) and stover (21.05 kg/ha), phosphorus uptake by seed (5.91 kg/ha) and stover (18.50 kg/ha) and potassium uptake by seed (10.78 kg/ha) and stover (13.01 kg/ha). This might also be attributed to better availability of nutrients in root zone coupled with increased metabolic activity at the cellular levels might have increased the nitrogen, phosphorus and potassium uptake. The results of present investigation are in agreements with the findings of Rao *et al.*[16], Ughreja and Chundawat[23], Sankat[17] and Sivkumaran *et al.* [20] in coriander.

Effect of phosphorus

Growth, Yield attributes and Yield

An examination of data (Table 1) showed that application of 60 kg P_2O_5/ha (P_4) resulted in significantly higher plant height of 9.24 cm, 48.62 cm and 60.47 cm and plant spread of 8.40 cm, 16.42 cm and 17.28 cm at 30, 60 DAS and at harvest, respectively, which was found at par with treatment P_3 (40 kg P_2O_5/ha) at 30 and 60 DAS only. Application of 60 kg P_2O_5/ha (P_4) recorded significantly higher number of branches per plant (22.22) also. While, significantly the lowest plant height, plant spared and number of branches per plant was recorded under treatment P_1 (control). An appraisal of data (Table 2), result were found in the yield attributes *viz.*, number of umbels per plant (12.42), number of umbellates per umbel (4.62), number of seeds per umbel (5.55), seed weight per plant (5.08 g) and 1000 seed weight (13.99 g), also seed yield (1422 kg/ha) and stover yield (1645 kg/ha) observed height values, were remained statistically at par with treatment P_3 (40 kg P_2O_5/ha), An adequate supply of phosphorus early in the life cycle of plant is important in laying down the primordia of its reproductive part. It also increases the initiation of both first and second order rootlets and their development. It was associate with stimulated root development, increased stalk and stem strength, improved flower formation and other yield attributes, more uniform and earlier crop maturity, improvements in crop quality, increased resistance to plant diseases and photosynthetic efficiency[5]. The extensive root system helps in exploiting the maximum nutrients and water from the soil[21]. This results in conformity with those reported by Jan *et al.* [8], Naghera[12] and Nandal *et al*[13].

Nutrient content and uptake by seed and stover of coriander

A perusal of data presented in Table 3 showed that treatment P_4 (60 kg P_2O_5/ha) registered higher phosphorus content in seed (0.34 %) and stover (0.078 %) and it was remained at par with treatment P_3 (40 kg P_2O_5/ha). Whereas, different levels of phosphorus do not exerted their significant influence on nitrogen and potassium content in seed and stover. As per data showed in Table 4, application of 60 kg P_2O_5/ha (P_4) recorded significantly higher nitrogen uptake by seed (34.72 kg/ha) and stover (18.50 kg/ha), phosphorus uptake by seed (5.64 kg/ha) and stover (1.28 kg/ha) & potassium uptake by seed (10.63 kg/ha) and stover (17.10 kg/ha), but it was all remained at par with 40 kg P_2O_5/ha (P_3). While the lowest was registered under treatment P_1 (control).

Thus, significant improvement in uptake of nitrogen, phosphorus and potassium might be attributed to their 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 Jamuna *et al.* [6], Ughreja and Chundawat[23], Naghera[12] and Garg *et al*[7].

INTERACTION EFFECT

Data from present investigation as reported in previous chapter revealed that the interaction effect of nitrogen and phosphorus levels was found non-significant for all the parameters.

ECONOMICS

The data in Table 5 clearly indicated that the highest net returns of ₹65976/ha and BCR of 3.48 were accrued with application of 60 kg N/ha, which was followed by N_3 (₹ 58209/ha and BCR of 3.22). With regard to phosphorus levels, application of 60 kg P_2O_5/ha (P_4) gave the highest net returns of ₹ 61008/ha and BCR of 3.26 by 40 kg P_2O_5/ha (P_3). This can be attributed to higher seed and stover yield recorded with these treatments along with comparably low cost. The findings are in close conformity with results of Bhati[2], Sankat[17], Naghera[12], Shroff[19], Mehta *et al.* [10] and Yadav *et al*[25].

Table 1: Effect of varying levels of nitrogen and phosphorus on growth parameters of coriander

Treatments	Plant height (cm)			Plant spread (cm)			Number of branches per plant
	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest	
Nitrogen levels (kg N/ha)							
N_1 - Control	6.94	39.39	46.43	6.17	12.14	13.10	11.67
N_2 – 20	7.74	43.18	50.47	7.61	13.94	15.00	16.12
N_3 – 40	8.57	49.63	58.99	7.97	16.31	17.33	21.20
N_4 – 60	10.74	58.01	65.44	8.85	18.21	19.60	28.56
S.Em. ±	0.33	1.15	1.45	0.22	0.33	0.32	0.55
C.D. at 5%	0.95	3.31	4.20	0.63	0.96	0.92	1.59
Phosphorus levels (kg P_2O_5/ha)							
P_1 - Control	7.88	49.61	53.77	6.99	13.41	14.64	16.95
P_2 – 20	7.89	43.74	51.86	6.84	14.88	16.16	17.82
P_3 – 40	8.98	48.22	55.21	8.36	15.89	16.94	20.56
P_4 – 60	9.24	48.62	60.47	8.40	16.42	17.28	22.22
S.Em. ±	0.33	1.15	1.45	0.22	0.33	0.32	0.55
C.D. at 5%	0.95	3.31	4.20	0.63	0.96	0.92	1.59
Interaction (N x P)							
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS
C.V.%	13.42	8.35	9.10	9.87	7.59	6.77	9.82

Table 2: Effect of varying levels of nitrogen and phosphorus on yield attributes and yield

Treatments	Number of umbels per plant	Number of umbellates per umbel	Number of seeds per umbellate	Seed weight per plant (g)	1000 seed weight (g)	Yield (kg/ha)		HI (%)
						Seed	Stover	
Nitrogen levels (kg N/ha)								
N_1 - Control	6.64	4.11	4.78	4.35	12.54	1196	1297	48.15
N_2 – 20	9.65	4.30	4.92	4.67	13.01	1282	1384	49.64
N_3 – 40	12.98	4.53	5.44	4.90	13.84	1357	1502	47.63
N_4 – 60	14.31	4.86	5.67	5.46	14.78	1483	1760	46.19
S.Em. ±	0.24	0.09	0.18	0.12	0.13	42	81	2.01
C.D. at 5%	0.69	0.26	0.51	0.35	0.38	121	236	NS
Phosphorus levels (kg P_2O_5/ha)								
P_1 - Control	8.97	4.26	4.76	4.58	13.12	1219	1298	50.56
P_2 – 20	10.01	4.33	4.97	4.69	13.61	1289	1387	48.25
P_3 – 40	12.17	4.60	5.53	5.02	13.46	1388	1613	46.23
P_4 – 60	12.42	4.62	5.55	5.08	13.99	1422	1645	46.57
S.Em. ±	0.24	0.09	0.18	0.12	0.13	42	81	2.01
C.D. at 5%	0.69	0.26	0.51	0.35	0.38	121	236	NS
Interaction (N x P)								
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS
C.V.%	7.42	6.71	11.36	8.46	3.38	10.89	17.61	13.73

Table 3: Effect of various levels of nitrogen and phosphorus on nutrient content by seed and stover

Treatments	Nitrogen content (%)		Phosphorus content (%)		Potash content (%)	
	Seed	Stover	Seed	Stover	Seed	Stover
Nitrogen levels (kg N/ha)						
N_1 - Control	2.23	1.17	0.330	0.075	0.755	1.003
N_2 – 20	2.41	1.26	0.331	0.077	0.747	1.001
N_3 – 40	2.49	1.34	0.331	0.075	0.755	1.025
N_4 – 60	2.56	1.42	0.336	0.075	0.726	1.042
S.Em. ±	0.01	0.01	0.002	0.001	0.008	0.012
C.D. at 5%	0.032	0.01	NS	NS	NS	NS
Phosphorus levels (kg P_2O_5/ha)						
P_1 - Control	2.41	1.30	0.314	0.072	0.735	1.004
P_2 – 20	2.41	1.29	0.330	0.074	0.743	1.006
P_3 – 40	2.43	1.30	0.342	0.077	0.756	1.022
P_4 – 60	2.42	1.29	0.343	0.078	0.750	1.040
S.Em. ±	0.01	0.01	0.002	0.001	0.008	0.012
C.D. at 5%	NS	NS	0.005	0.001	NS	NS
Interaction (N x P)						
C.D. at 5%	NS	NS	NS	NS	NS	NS
C.V.%	1.58	1.38	1.62	3.00	3.87	4.17

Table 4 Effect of various levels of nitrogen and phosphorus on nutrient uptake by seed and stover

Treatments	Nitrogen uptake (kg/ha)		Phosphorus uptake (kg/ha)		Potash uptake (kg/ha)	
	Seed	Stover	Seed	Stover	Seed	Stover
Nitrogen levels (kg N/ha)						
N_1 - Control	26.66	14.02	4.30	0.97	9.05	13.01
N_2 – 20	30.91	16.15	4.63	1.07	9.57	13.81
N_3 – 40	33.77	18.18	4.98	1.12	10.24	15.43
N_4 – 60	37.98	21.05	5.91	1.32	10.78	18.33
S.Em. ±	0.98	0.54	0.26	0.06	0.31	0.85
C.D. at 5%	2.82	1.57	0.75	0.18	0.89	2.46
Phosphorus levels (kg P_2O_5/ha)						
P_1 - Control	29.50	15.97	4.09	0.93	8.94	13.04
P_2 – 20	31.17	16.76	4.58	1.03	9.59	13.96
P_3 – 40	33.92	18.17	5.52	1.24	10.48	16.46
P_4 – 60	34.72	18.50	5.64	1.28	10.63	17.10
S.Em. ±	0.98	0.54	0.26	0.06	0.31	0.85
C.D. at 5%	2.82	1.57	0.75	0.18	0.89	2.46
Interaction (N x P)						
C.D. at 5%	NS	NS	NS	NS	NS	NS
C.V.%	10.48	11.01	16.77	17.59	10.75	18.09

Table 5: Economics of different treatments

Treatment	Gross return (₹/ha)	Cost of cultivation (₹/ha)	Net Return (₹/ha)	BCR
Nitrogen levels (kg N/ha)				
N_1 – Control	74375	25578	48797	2.90
N_2 – 20	79673	25888	53784	3.08
N_3 – 40	84409	26199	58209	3.22
N_4 – 60	92486	26510	65976	3.48
Phosphorus levels (kg P_2O_5/ha)				
P_1 – Control	75736	24481	51255	3.09
P_2 – 20	80114	25523	54591	3.14
P_3 – 40	86478	26565	59913	3.26
P_4 – 60	88614	27606	61008	3.20

CONCLUSION

Based on the one year experimental results, it seems quite logical to conclude that 60 kg N/ha (half dose of nitrogen as basal and remaining half dose at 30 DAS) and 60 kg P_2O_5/ha (full doses of phosphorus as basal) is optimum for higher production & net returns from coriander on clayey soil under South Saurashtra agro-climatic condition.

REFERENCES

1. Bedse, R. D., Amin, A. U., Raval, C. H. and Vaghela, S. J. Effect of rate and time of nitrogen application on seed yield, quality and economics of cumin under loamy sand soils. *Inte. J. of Agri. Sci.*, **9(1)**: 201-203 (2013).
2. Bhati, D. S. Effect of stage of umbel picking and nitrogen fertilization on fennel. *Indian Journal of Agronomy*, **35(4)**: 375-379 (1990).
3. Brady, N. C. The Nature and Properties of Soils. Prentice Hall of India Pvt. Ltd, New Delhi, pp. 501-502 (1996).
4. Cochran, W. G. and Cox, G. M. Experimental Designs, II Edition. John Wiley and Sons, Singapore. (1967).
5. Crop Nutrition. 2016: Crop Nutrition-Trusted Crop Nutrition Expertise. Available at http://www. cropnutrition.com/> accessed 14 May, 2016.

6. Garg, V. K., Singh, P. K. and Katiyar, R. S. Yield, mineral composition and quality of coriander and fennel, grown in sodic soil. *Ind. J. of Agri. Sci.*, **74**: 221-223 (2004).
7. Jamuna, P., Rao, P. N., Reddy, P. V. and Rao, M. R. Phosphorus requirement of coriander in black clay soil (vertisol) of low availability P_2O_5. *Indian Cocoa, Arecanut and Spices Journal*, **14(3)**: 112-123 (1992).
8. Jan, I., Sajid, M., Shah, A., Rab, R., Khan, N. H., Wahid, F. I., Rahman, A., Alam, R. and Alam, H. Response of seed yield of coriander to phosphorus and row spacing, *Sarh. . of Agri.* **27(4)**: 549-552 (2011).
9. Khalid, A. K. Effect of phosphorus fertilization on anis, coriander and sweet fennel plant growing under arid region conditions. *Medicinal and Aromatic Plant Science and Biotechnology*, **6**(Special Issue 1): 127-131 (2012).
10. Mehta, R. S., Lal, G. and Vishal, M. K. Growth and yield of coriander as influenced by irrigation and nutrient levels with varying crop geometry. *Ann. of Agri. Res. New Series*, **34(3)**: 205-209 (2013).
11. Moosavi, G., Seghatoleslami, M., Ebrahimi, A., Fazeli, M. and Jouyban, Z. The effect of nitrogen rate and plant density on morphological traits and essential oil yield of coriander. *J. of Orna. and Horti. Pla.*, **3(2)**: 95-103 (2013).
12. Naghera, R. P. Response of coriander to different sowing date under varying levels of nitrogen and phosphorus. M.Sc. (Agri.) Thesis (Unpublished). Gujarat Agricultural University, Junagadh (1997).
13. Nandal, J. ., Dahiya, M. S., Gupta, V., Bamel, J. and Telhan, S. K. Response of spacing, phosphorus level and cutting of leaves on growth and yield of coriander. *Indian Journal of Horticulture*, **67**: 271-275 (2010).
14. Nowak, J. and Szempliński, W. Effect of nitrogen and boron fertilization on the morphometric features and yield of coriander. *Act. Scie. Polo. Agri.*, **10(3)**: 111-118 (2011).
15. Patel, C. B., Amin, A .U. and Patel, A. L. Effect of varying levels of nitrogen and sulphur on growth and yield of coriander. *The Bios.*, **8(4)**: 1285-1289 (2013).
16. Rao, E. V. S. P., Singh, M., Narayan, M. R. and Rao, R. S. G. Fertilizer studies in coriander. *J. of Agri.l Sci.*, **100(1)**: 251-252 (1983).
17. Sankat, K. B. Response of coriander to irrigation, nitrogen and phosphorus. M.Sc. (Agri.) Thesis (Unpublished). Gujarat Agricultural University, Sardarkrushinagar (1993).
18. Schnug, E. Sulphur in Agro-ecosystem. Kluwer Acad. Publ, Dordrecht, Netherlands, pp. 115-123 (1998).
19. Shroff, J. C. Influence of nitrogen and weed management practices on growth and seed yield of coriander cv. GC 2 under middle Gujarat condition. M.Sc. (Agri.) Thesis (Unpublished). Gujarat Agricultural University, Anand (2003).
20. Sivkumaran, S., Hunsigi, G., Basavaraju, H.K. and Sridhara, S. Study on nutrient uptake, seed and oil yield of coriander as influenced by N, P and S. *Ind. Agri.*, **40(2)**: 89-92 (1996).
21. Tandon, H. L. S. Phosphorus Research and Agricultural Production in India. Fertilizer Development and Consultation Organization, New Delhi, India, pp.160 (1987).
22. Tarafdar, J. C. Mobilization of native phosphorus for plant nutrition. *J. of the Ind. Soci. of Soil Sci.*, **56**: 388-394 (2008).
23. Ughreja, P. P. and Chundawat, B. S. Nutrition studies in coriander. *Gujarat Agricultural University Research Journal*, **17(2)**: 82-86 (1992).
24. Vance, C. P., Uhde-stonea, C. and Allan, D.L. 2003. Phosphorus and use critical adaptations by plant securing a non-renewable resources. *New Phyto.*, **157**: 423-433.
25. Yadav, S. S., Choudhary, I., Yadav, R. L. and Keshwa, G. L. Growth and yield of coriander as influenced by weed management and nitrogen levels. *Ind. J. of Agron.*, **58(4)**: 597-602 (2013).
26. Yawalkar, K. S. Manures and Fertilizers. Agri Horticultural Publishing House, Nagpur (Maharashtra). pp. 4-11 (1984).