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Nutritional Studies in Coriander (*Coriandrum sativum* L.) III : Level of Nutrient in Various Plant Parts

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ABSTRACT

Application of nitrogen increased N level in coriander grain whereas in leaves significant effect was only noticed at Deesa with 60 kg N/ha. Ca level in grain was also increased significantly at Deesa and in pooled analysis, though the effect of N_{30} and N_{60} was at par statistically. The level of P, K and Mg was reduced in coriander plant parts with N application. Phosphorus application tended to increase P, K, Ca and Mg level in coriander plant, whereas it reduced K level in root at Jugudan and Ca level in leaves at Deesa. K application increased K level in coriander, while its effect was observed to be non-significant on concentration of other elements in coriander plants. In general, the level of N and P was higher in grain, K was higher in grain and leaves, whereas Ca and Mg were higher in leaves as compared to other parts of coriander plant.

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INTRODUCTION

Coriander (*Coriandrum sativum* L.) is one of the most important spice crop of India. Hardly any information is available on the distribution of nutrients in various plant parts at harvest under the influence of different levels of fertilization, which is important in signifying the importance of nutrients in different components of a plant. This investigation was planned to suggest optimum level of N, P and K for the recommended variety of coriander (Gujarat Coriander-1) under two agro-climatic locations. As a part of the study, the investigation was also carried out to know the effect of different levels of NPK fertilizers on N, P, K, Ca and Mg levels in different plant parts of coriander.

MATERIALS AND METHODS

The details of the experimentation has been given in I-part of this study on total nutrient uptake (Ughreja and Chundawat, 1988). To understand the distribution of N, P, K, Ca and Mg levels in various plant parts of coriander, the samples of leaves were taken at harvest, straw and grain samples were drawn after threshing and root samples were dug out from field just after harvest. Air dried samples of roots, straw, leaves and seeds were ground in order to make powder form in a wiley mill and used for analysis. Total N in micro-kjeldahl digest of the plant samples was estimated by the method of A.O.A.C. (1980).

An acid extract of coriander roots, straw, leaves and seed samples were prepared by digesting in triacid ($HNO_3 + HC10_4 + H_2SO_4$:10 : 4 : 1) as described by Jackson (1973). Total P and K were determined by colorimetric determination as Vanadomolybdo phosphoric acid yellow colour method and by Flame Photometry determination method respectively. Ca and Mg were estimated by Versenate (EDTA) titration method (Jackson 1973). The levels of different elements were than worked out as per procedure of estimation in different parts.

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RESULTS AND DISCUSSION

The effect of nitrogen fertilization of N level in grain, straw and roots at both the locations was non-significant, while in pooled data N level varied significantly in grain and 60 kg N/ha gave the highest N level. In leaves the significant effect was only noticed with 60 kg N/ha at Deesa (Table 1). The effect of nitrogen application on Ca level was significant only in grain at Deesa and pooled data (Table 4). The level of P, K and Mg was reduced with applied nitrogen. The reason for lack of significant effect on level of N in various plant parts due to N fertilization might be due to the fact that nitrogen fertilizer greatly stimulated plant growth which had diluted the effect of higher uptake of N, because the nitrogen content of the fertilized crop has been expressed as a per cent of its dry or fresh weight which had significantly increased in this investigation. Similar statement has also been made by Russel (1973). The vigorous growth causes a dramatic reduction in the mineral content of the plant by dilution was also been mentioned by Mengal and Kirkby (1979).

The effect of phosphorus as well as potash application was non-significant on N level in grain, straw, leaves and roots. Different doses of N fertilization had significant effect on P level in grain and straw at Jagudan, while at Deesa and pooled data effect was non-significant. There was a dicline in the level of P with N application. Similar trend was also observed in coriander leaves and roots (Table 2). The results are in confirmity with the work reported by Rajeswara Rao *et al.* (1989). While estimating nutrient uptake of davana, N application decreased the P content in the plant with no significant differences among the N levels.

The effect of different doses of fertilizers application also signified that application of N had declined the K level in plant (Table 3). The results are supported by Barbagallow and Silvia (1964) that low N fertilization resulted in poor utilization of P and K. This may be the reason why P and K at N_0 was higher as compared to N doses.

Phosphorus application tended to increase the level of P in various plant parts. However, significant increase was only at Deesa, both in grain as well as in straw with P_{30} and P_{60} respectively. The observations are in accordance with the findings of Kumar and Singh (1980) that the significant response of P fertilizer on P concentration in grain and straw of chickpea, further it is reasonable to believe that with P application, the level of P in plant tissues will increase provided it is not diluted by its stimulating effect on vegetative growth. Therefore, at Deesa where plants had comparatively lesser vegetative growth and dry matter production, a significant increase in P level has been noticed.

Potassium, application had no significant effect on P level in various coriander plant tissues. These findings are in agreement with the results reported by Kalra and Tripathi (1980), that in sunflower phosphorus concentration in plant was not affected due to application of potassium.

P application significantly increased K level in straw and leaves at Deesa and recorded highest K level with 60 kg P/ha. Application of K did not bring out any significant variation in K level in grain, whereas in straw significant effect was noticed at Jagudan and in pooled data. Similarly response of applied K on K level in coriander leaves was also observed at both the locations and in pooled data. This finding was in line with the results of Bankar and Mukhopadhyay (1990) that in tuberose leaves K content was significantly increased with application of K_2O. In coriander roots significant effect of K fertilization was only noticed in pooled data.

Nitrogen application significantly increased Ca level in grain at Deesa and in pooled analysis, whereas at Jagudan, effect of N fertilization was positive but not significant. P application also increased Ca content in grain

TABLE 1

Effect of NPK fertilizers on N level (%) in various plant parts of coriander.

Treatment	Grain			Straw			Leaves			Roots		
	Jagu-dan	Deesa	Pooled	Jagu-dan	Deesa	Poo-led	Jagu-dan	Deesa	Pooled	Jagu-dan	Deesa	Poo-led
N level (kg/ha) :												
N_0	2.12	2.32	2.22	0.33	0.38	0.35	1.21	1.18	1.20	0.34	0.30	0.32
N_{30}	2.13	2.39	2.26	0.28	0.36	0.32	1.15	1.16	1.15	0.29	0.30	0.30
N_{60}	2.23	2.48	2.36	0.30	0.38	0.34	1.17	1.38	1.27	0.32	0.29	0.31
S. Em. ±	0.04	0.05	0.03	0.01	0.02	0.01	0.04	0.04	0.07	0.02	0.01	0.01
C. D. at 5%	N. S.	N.S.	0.10	N.S.	N.S.	N.S.	N.S.	0.12	N.S.	N.S.	N.S.	N.S.
P level (kg/ha)												
P_0	2.20	2.39	2.29	0.32	0.37	0.35	1.20	1.29	1.24	0.32	0.29	0.30
P_{30}	2.15	2.38	2.27	0.29	0.35	0.32	1.15	1.23	1.19	0.31	0.30	0.31
P_{60}	2.13	2.42	2.28	0.30	0.40	0.35	1.18	1.20	1.19	0.32	0.30	0.31
S. Em. ±	0.04	0.05	0.03	0.01	0.02	0.01	0.04	0.04	0.03	0.02	0.01	0.01
C. D. at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
K level (kg/ha)												
K_0	2.17	2.39	2.28	0.29	0.36	0.33	1.19	1.28	1.24	0.32	0.30	0.31
K_{30}	2.15	2.41	2.28	0.31	0.39	0.35	1.16	1.20	1.18	0.32	0.29	0.30
S. Em. ±	0.04	0.04	0.03	0.01	0.01	0.01	0.03	0.03	0.02	0.02	0.01	0.01
C. D. at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
C. V. %	7.10	7.22	7.18	15.01	16.85	16.23	11.05	11.13	11.10	17.01	11.01	14.53
Location												
Jagudan	-	-	2.16	-	-	0.30	-	-	1.18	-	-	0.32
Deesa	-	-	2.40	-	-	0.37	-	-	1.24	-	-	0.30
S. Em. ±	-	-	0.03	-	-	0.01	-	-	0.02	-	-	0.01
C. D. at 5%	-	-	0.08	-	-	0.03	-	-	N.S.	-	-	N.S.
C.V. %	-	-	7.18	-	-	16.23	-	-	11.10	-	-	14.53

N. S = Non Significant.

TABLE 2

Effect of NPK fertilizers on P level (%) in various plant parts of coriander.

Treatment	Grain			Straw			Leaves			Roots		
	Jagu-dan	Deesa	Pooled	Jagu-dan	Deesa	Poo-led	Jagu-dan	Deesa	Pooled	Jagu-dan	Deesa	Poo-led
N level (kg/ha) :												
N_0	0.59	0.67	0.63	0.08	0.11	0.09	0.25	0.31	0.28	0.09	0.05	0.07
N_{30}	0.50	0.63	0.56	0.05	0.11	0.08	0.15	0.24	0.20	0.07	0.05	0.06
N_{60}	0.43	0.64	0.57	0.07	0.11	0.09	0.12	0.19	0.15	0.08	0.05	0.06
S. Em. ±	0.01	0.01	0.03	0.01	0.00	0.01	0.02	0.01	0.01	0.00	0.01	0.00
C. D. at 5%	0.04	N.S.	N.S.	0.02	N.S.	N.S.	0.05	0.03	0.03	0.01	N.S.	N.S.
P level (kg/ha)												
P_0	0.51	0.62	0.56	0.06	0.09	0.08	0.17	0.23	0.20	0.08	0.05	0.06
P_{30}	0.52	0.66	0.59	0.06	0.11	0.08	0.17	0.24	0.21	0.08	0.05	0.06
P_{60}	0.49	0.65	0.57	0.07	0.13	0.09	0.18	0.26	0.22	0.08	0.05	0.06
S. Em. ±	0.01	0.01	0.01	0.01	0.00	0.00	0.02	0.01	0.01	0.00	0.01	0.00
C. D. at 5%	N.S.	0.04	N.S.	N.S.	0.01	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
K level (kg/ha)												
K_0	0.50	0.64	0.57	0.06	0.10	0.08	0.16	0.25	0.21	0.07	0.05	0.06
K_{30}	0.51	0.65	0.58	0.07	0.11	0.09	0.18	0.25	0.22	0.08	0.05	0.06
S. Em. ±	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00
C. D. at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
C. V. %	8.32	6.56	7.33	30.69	13.45	21.59	31.99	14.91	22.41	22.07	41.40	29.53
Location												
Jagudan	-	-	0.51	-	-	0.07	-	-	0.17	-	-	0.0.8
Deesa	-	-	0.65	-	-	0.10	-	-	0.25	-	-	0.05
S. Em. ±	-	-	0.01	-	-	0.00	-	-	0.01	-	-	0.00
C. D. at 5%	-	-	0.02	-	-	0.01	-	-	0.02	-	-	0.01
C.V. %	-	-	7.33	-	-	21.59	-	-	22.41	-	-	29.53

N. S.=Non Significant.

TABLE 3

Effect of NPK fertilizers on K level (%) in various plant parts of coriander.

Treatment	Grain			Straw			Leaves			Roots		
	Jagudan	Deesa	Pooled	Jagudan	Deesa	Pooled	Jagudan	Deesa	Pooled	Jagudan	Deesa	Pooled
N level (kg/ha) :												
N_0	1.37	1.50	1.43	0.97	0.77	0.87	2.23	1.18	1.71	0.40	0.18	0.29
N_{30}	1.30	1.37	1.34	0.77	0.64	0.71	1.82	1.12	1.47	0.30	0.15	0.23
N_{60}	1.23	1.22	1.22	0.60	0.54	0.57	1.19	0.73	0.96	0.26	0.13	0.20
S. Em. ±	0.03	0.03	0.02	0.02	0.02	0.03	0.10	0.05	0.15	0.01	0.01	0.02
C. D. at 5%	0.08	0.09	0.06	0.06	0.07	0.20	0.29	0.15	N.S.	0.03	0.03	N.S.
P level (kg/ha)												
P_0	1.30	1.37	1.34	0.82	0.58	0.70	1.74	0.89	1.32	0.34	0.14	0.24
P_{30}	1.32	1.38	1.35	0.77	0.64	0.70	1.67	1.06	1.36	0.33	0.16	0.25
P_{60}	1.28	1.33	1.31	0.76	0.74	0.75	1.84	1.08	1.46	0.30	0.16	0.23
S. Em. ±	0.03	0.03	0.02	0.02	0.02	0.05	0.01	0.05	0.06	0.01	0.01	0.01
C. D. at 5%	N.S.	N.S.	N.S.	N.S.	0.07	N.S.	N.S.	0.15	N.S.	0.03	N.S.	N.S.
K level (kg/ha)												
K_0	1.30	1.33	1.32	0.76	0.63	0.69	1.56	0.92	1.24	0.31	0.15	0.23
K_{30}	1.31	1.39	1.35	0.81	0.67	0.74	1.93	1.10	1.52	0.33	0.16	0.25
S. Em. ±	0.02	0.03	0.02	0.02	0.02	0.01	0.08	0.04	0.05	0.01	0.01	0.01
C. D. at 5%	N.S.	N.S.	N.S.	0.05	N.S.	0.04	0.24	0.12	0.13	N.S.	N.S.	0.02
C. V. %	7.24	7.82	7.55	9.09	13.12	10.97	19.47	17.18	19.69	11.83	19.34	14.37
Location	-	-	1.30	-	-	0.78	-	-	1.75	-	-	0.32
Jagudan	-	-	1.36	-	-	0.65	-	-	1.01	-	-	0.15
Deesa	-	-	0.02	-	-	0.01	-	-	0.05	-	-	0.01
S. Em. ±	-	-	0.05	-	-	0.04	-	-	0.13	-	-	0.02
C. D. at 5%	-	-	7.55	-	-	10.97	-	-	19.59	-	-	14.37
C.V. %	-	-										

TABLE 4

Effect of NPK fertilizers on Ca level (%) in various plant parts of coriander.

Treatment	Grain			Straw			Leaves			Roots		
	Jagu-dan	Deesa	Pooled	Jagu-dan	Deesa	Poo-led	Jagu-dan	Deesa	Pooled	Jagu-dan	Deesa	Poo-led
N level (kg/ha) :												
N_0	0.65	0.63	0.64	0.41	0.52	0.47	2.73	2.88	2.81	0.48	0.47	0.48
N_{30}	0.72	0.72	0.72	0.42	0.52	0.47	2.86	3.09	2.97	0.47	0.45	0.46
N_{60}	0.66	0.74	0.70	0.45	0.52	0.48	2.91	2.95	2.93	0.52	0.45	0.48
S. Em. ±	0.03	0.01	0.02	0.01	0.02	0.01	0.07	0.09	0.05	0.02	0.02	0.01
C. D. at 5%	N.S.	0.04	0.05	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
P level (kg/ha)												
P_0	0.65	0.72	0.67	0.43	0.50	0.46	2.87	3.15	3.01	0.47	0.47	0.47
P_{30}	0.71	0.65	0.68	0.42	0.51	0.47	2.73	3.00	2.86	0.49	0.45	0.47
P_{60}	0.67	0.73	0.70	0.44	0.55	0.49	2.90	2.76	2.83	0.51	0.45	0.48
S. Em. ±	0.03	0.01	0.04	0.01	0.02	0.01	0.07	0.09	0.12	0.02	0.02	0.01
C. D. at 5%	N.S.	0.04	N.S.	N.S.	N.S.	N.S.	N.S.	0.26	N.S.	N.S.	N.S.	N.S.
K level (kg/ha)												
K_0	0.69	0.70	0.70	0.42	0.52	0.47	2.82	2.98	2.90	0.50	0.44	0.47
K_{30}	0.66	0.69	0.67	0.43	0.52	0.48	2.85	2.96	2.90	0.48	0.47	0.48
S. Em. ±	0.03	0.01	0.01	0.01	0.01	0.01	0.05	0.07	0.04	0.02	0.02	0.01
C. D. at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
C. V. %	16.22	7.07	12.40	10.29	10.41	10.41	8.16	10.01	9.18	13.45	14.05	13.74
Location												
Jagudan	-	-	0.68	-	-	0.43	-	-	2.83	-	-	0.49
Deesa	-	-	0.70	-	-	0.52	-	-	2.97	-	-	0.46
S. Em. ±	-	-	0.01	-	-	0.01	-	-	0.04	-	-	0.01
C. D. at 5%	-	-	N.S.	-	-	0.02	-	-	0.13	-	-	0.03
C.V. %	-	-	12.40	-	-	10.41	-	-	9.18	-	-	13.74

N.S.= Non Significant.

TABLE 5

Effect of NPK fertilizers on Mg level (%) in various plant parts of coriander.

Treatment	Grain			Straw			Leaves			Roots		
	Jagu-dan	Deesa	Pooled	Jagu-dan	Deesa	Poo-led	Jagu-dan	Deesa	Pooled	Jagu-dan	Deesa	Poo-led
N level (kg/ha) :												
N_0	0.48	0.53	0.51	0.19	0.28	0.23	1.20	1.51	1.36	0.28	0.28	0.28
N_{30}	0.43	0.47	0.45	0.17	0.24	0.21	1.10	1.38	1.24	0.25	0.30	0.27
N_{60}	0.45	0.47	0.46	0.16	0.24	0.20	1.07	1.37	1.22	0.24	0.29	0.26
S.Em. ±	0.02	0.02	0.02	0.01	0.01	0.01	0.05	0.04	0.04	0.02	0.02	0.01
C. D. at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	0.02	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
P level (kg/ha)												
P_0	0.47	0.46	0.46	0.18	0.24	0.21	1.07	1.36	1.22	0.24	0.29	0.27
P_{30}	0.44	0.53	0.48	0.16	0.25	0.21	1.16	1.46	1.31	0.28	0.30	0.29
P_{60}	0.46	0.50	0.48	0.17	0.28	0.23	1.14	1.44	1.29	0.24	0.28	0.26
S.Em.±	0.02	0.02	0.02	0.01	0.01	0.01	0.05	0.04	0.04	0.02	0.02	0.01
C. D. at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
K level (kg/ha)												
K_0	0.43	0.49	0.46	0.17	0.25	0.21	1.13	1.40	1.27	0.27	0.29	0.28
K_{30}	0.47	0.49	0.48	0.18	0.26	0.22	1.12	1.44	1.28	0.24	0.29	0.27
S.Em.±	0.02	0.02	0.01	0.01	0.01	0.01	0.04	0.04	0.03	0.01	0.01	0.01
C.D. at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
C. V. %	18.45	15.92	17.14	19.61	16.54	17.89	16.73	10.85	13.52	21.42	21.22	21.35
Location												
Jagudan	-	-	0.45	-	-	0.17	-	-	1.13	-	-	0.25
Deesa	-	-	0.49	-	-	0.25	-	-	1.42	-	-	0.29
S.Em. ±	-	-	0.01	-	-	0.01	-	-	0.03	-	-	0.01
C.D. at 5%	-	-	0.04	-	-	0.02	-	-	0.08	-	-	0.03
C.V. %	-	-	17.14	-	-	17.89	-	-	13.52	-	-	21.35

N. S.= Non Significant.

at both the locations and in pooled data, though, significant increase was observed only at Deesa. Potash application did not cause any significant differences on calcium level in coriander plant parts (Table 4). These findings are in agreement with Singh *et al.* (1983) who reported that K did not influence the uptake of calcium whereas N proved to be significantly effective for Ca uptake by radish root. Further Mengal and Kirkby (1979) reported that potassium being a competive element of calcium is not likely to alter it very much in plant parts.

The response of applied N was negative and at N_{30} and N_{60} application magnesium level in straw declined.Similar trend was also observed in coriander leaves also, whereas N application did not cause significant variation in Mg level in coriander grains and roots. The Mg level of coriander plant parts was not significantly affected by the application of P and K.

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