

Original Research Article

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## Effect of Integrated Nutrient Management on Growth Parameters of Coriander (*Coriandrum sativum* L.) Cultivars under Telangana Conditions

P. Suman\*, D. Lakshminarayana, P. Prasanth and D. Saida Naik

Department of Plantation, Spices, Medicinal and Aromatic crops, College of Horticulture, Sri Konda Laxman Telangana State Horticultural University, Rajendranagar-500 030, Hyderabad, India

\*Corresponding author

### ABSTRACT

A field experiment was conducted during *rabi* 2017-18 at PG block, College of Horticulture, Sri Konda Laxman Telangana State Horticultural University, Hyderabad, Telangana, India, to study the effect of integrated nutrient management on growth parameters of coriander (*Coriandrum sativum* L.) cultivars. The experiment was evaluated in randomized block design with factorial concept consists two factors like Cultivars and Inorganic, Organic and Bio fertilizers. The first factor comprised of two cultivars i.e. AD-1 and Suguna besides the second factor consists fertilizer levels of F<sub>1</sub> - 100% RDF (15-40-20 NPK Kg ha<sup>-1</sup>), F<sub>2</sub> - 75% RDF + Farmyard Manure (FYM @10 t ha<sup>-1</sup>) + *Azospirillum* and PSB (5g Kg<sup>-1</sup> of seed as seed inoculation + 5 Kg ha<sup>-1</sup> as soil application), F<sub>3</sub> - 75% RDF + Vermicompost (VC @ 5t ha<sup>-1</sup>) + *Azospirillum* and PSB (5g Kg<sup>-1</sup> of seed as seed inoculation + 5 Kg ha<sup>-1</sup> as soil application), F<sub>4</sub> - 50% RDF + Farmyard Manure (FYM @10 t ha<sup>-1</sup>) + *Azospirillum* and PSB (5g Kg<sup>-1</sup> of seed as seed inoculation + 5 Kg ha<sup>-1</sup> as soil application), F<sub>5</sub> - 50% RDF + Vermicompost (VC @ 5t ha<sup>-1</sup>) + *Azospirillum* and PSB (5g Kg<sup>-1</sup> of seed as seed inoculation + 5 Kg ha<sup>-1</sup> as soil application). Ten treatment combinations were replicated thrice. Among the treatments, F<sub>3</sub>-75% RDF + Vermicompost @ 5t ha<sup>-1</sup> + *Azospirillum* and PSB (5g Kg<sup>-1</sup> of seed as seed inoculation + 5 Kg ha<sup>-1</sup> as soil application) with the variety V<sub>2</sub>-Suguna recorded least number of days taken to 50 per cent and 100 per cent seed germination and maximum plant height, number of secondary branches per plant, leaf area, minimum number of days taken to first and 50 per cent flowering, number of umbels per plant and umbellate per umbel.

### Keywords

*Azospirillum*, PSB, FYM, Vermicompost, RDF, AD-1 and Suguna

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### Introduction

Coriander (*Coriandrum sativum* L.) is an annual herbaceous plant locally known as *Dhania* belongs to the family Apiaceae and is native to the Mediterranean region. The name was derived from the Greek word 'koris' and was given on accounts of its unpleasant odour

of unripe green fruits. Coriander is extensively grown in Bangladesh, India, Russia, Central Europe and Morocco and it has been cultivated since human antiquity (Bhuiyan *et al.*, 2009). India is the biggest producer, consumer and exporter of coriander in the world and is mainly grown in Rajasthan, Gujarat, Andhra Pradesh, Madhya Pradesh,

Tamil Nadu, Orissa, Karnataka and Telangana.

In India coriander is cultivated in an area of 6.74 lakh ha with a production of 8.83 lakh MT, where as in Telangana, the area and production are 10,000 ha and 400 MT respectively (National Horticulture Board, 2016).

In recent years, bio fertilizers have emerged as an important component of integrated nutrient supply system and have shown promise to improve crop yields and nutrient supplies. *Azotobacter*, PSB and *Azospirillum* are the most wide spread bio fertilizers significantly contributing N, P and K to plants and also providing resistance to drought situation (Maheshwari *et al.*, 1991).

The application of nutrients through various sources is newer approach and being advocated for sustainable production. The integrated nutrient management has a crucial role in improving the plant physiology characters that builds levels of resistance and reduces the incidence of disease and pest attacks (Mirchandani and Mirchandani, 2005). Nitrogen fixing bacteria like *Azospirillum* have a great potential to reduce the nitrogenous fertilizer requirements whereas, Phosphorus solubilising bacteria is known to make the soil fixed phosphorus in to readily available form, subsequently increased the productivity of the crops.

### **Materials and Methods**

Present field experiment was conducted during *rabi* 2017-18 at PG block, College of Horticulture, Sri Konda Laxman Telangana State Horticultural University, Hyderabad, Telangana, India.

The experiment was carried out with two varieties i.e. AD-1 and Suguna with five

fertilizer levels i.e. 100% RDF (15-40-20 NPK Kg ha<sup>-1</sup>), 75% RDF + Farmyard Manure (FYM @ 10 t ha<sup>-1</sup>) + *Azospirillum* and PSB (5g Kg<sup>-1</sup> of seed as seed inoculation + 5 Kg ha<sup>-1</sup> as soil application), 75% RDF + Vermicompost (VC @ 5t ha<sup>-1</sup>) + *Azospirillum* and PSB (5g Kg<sup>-1</sup> of seed as seed inoculation + 5 Kg ha<sup>-1</sup> as soil application), 50% RDF + Farmyard Manure (FYM @ 10 t ha<sup>-1</sup>) + *Azospirillum* and PSB (5g Kg<sup>-1</sup> of seed as seed inoculation + 5 Kg ha<sup>-1</sup> as soil application), 50% RDF + Vermicompost (VC @ 5t ha<sup>-1</sup>) + *Azospirillum* and PSB (5g Kg<sup>-1</sup> of seed as seed inoculation + 5 Kg ha<sup>-1</sup> as soil application) in a Factorial Randomized Block Design and replicated thrice. Seeds were sown in the plot of 2 m × 1.5 m at spacing of 30 cm × 10 cm.

The recommended dosages of N, P and K @ 15:40:20 kg ha<sup>-1</sup> were applied in the form of urea, single super phosphate and muriate of potash respectively. Urea was applied in the three splits, the first as basal application and the other two doses at 25 and 50 days after sowing. The entire dose of single super phosphate and muriate of potash were applied at the time of sowing as basal dose. The vermicompost and the farmyard Manure were incorporated in to respective plots just prior to sowing of seed and then slightly covered with the fine soil.

Slurry of 200 g of each of *Azospirillum* and Phosphorous Solubilising Bacteria were dissolved in 1000 ml of jaggery solution (100 g of jaggery in 1000 ml of water) separately and combination of both 100 g *Azospirillum* and 100 g Phosphorous Solubilising Bacteria were dissolved in 1000 ml of jaggery solution. The coriander seeds were dipped in the slurry for about 30 minutes before sowing. Need based cultural and plant protection operations were taken up to the seed harvest. Five plant samples from each replication were selected at random to record data on growth characters. The experimental data was analysed

statistically by the method of analysis of variance as outlined by Panse and Sukhatme (1985).

## Results and Discussion

### Growth parameters

Growth parameters such as plant height, number of secondary branches per plant and leaf area showed a significant difference between fertilizer levels and varieties at 60, 90 days and at harvest stage.

Among the treatments, F<sub>3</sub>-75% RDF + Vermicompost @ 5t ha<sup>-1</sup> + *Azospirillum* and PSB (5g Kg<sup>-1</sup> of seed as seed inoculation + 5 Kg ha<sup>-1</sup> as soil application) with the variety V<sub>2</sub>-Suguna recorded higher plant height (97.67 cm) (Table 1), number of secondary branches per plant (18.30) (Table 2) and maximum leaf area (79.73 cm<sup>2</sup>) (Table 3) at harvest stage.

It was due to the seed treatment with *Azospirillum* and Phosphorous solubilising bacteria enhanced the nitrogen and other nutrients availability, resulted in increased vegetative growth (Mounika *et al.*, 2018). Similar results were also reported by Sahu *et al.*, (2014), Tripathi *et al.*, (2013) and Hnamte *et al.*, (2013) in coriander who stated that synergistic effect of inorganic and organic fertilizer increased plant height.

Integrated application of bio fertilizers with inorganic fertilizers have increased plant height by enhancing the nitrogen content and the rate of photosynthesis which is in agreement with (Migahed *et al.*, 2004; Choudhary *et al.*, 2004).

More number of secondary branches per plant was due to higher plant height, subsequently more photosynthates, led to production of more number of secondary branches per plant. The present investigation was in consistent

with other reports of Sahu *et al.*, (2014) in coriander, who stated that more number of secondary branches per plant was due to treatment supplied with bio-fertilizers and organic manures.

Maximum leaf area was due to the balanced fertilizer application increased leaf area which might be due to the availability of all nutrients in the rhizosphere (Priyadarshini *et al.*, 2017). Similar results reported by Nagar *et al.*, (2009) in coriander, who reported that available nutrients favoured better growth and development of the crop.

### Flowering parameters

Flowering parameters such as number of days taken to first and 50 per cent flowering, number of umbels per plant and umbellate per umbel showed a significant difference between fertilizer levels and varieties. Among the treatments, F<sub>3</sub>-75% RDF + Vermicompost @ 5t ha<sup>-1</sup> + *Azospirillum* and PSB (5g Kg<sup>-1</sup> of seed as seed inoculation + 5 Kg ha<sup>-1</sup> as soil application) with the variety V<sub>2</sub>-Suguna recorded minimum number of days taken to first flowering (39.00 days) and 50 per cent flowering (47.30 days) (Table 4). Similarly the same treatment recorded maximum number of umbels per plant (37.50) and umbellate per umbel (8.53) (Table 5).

Least number of days taken to first flowering and 50 per cent flowering might be due that bio fertilizer treated plants became physiologically more active and enable to synthesize required amounts of hormones. The results are comparable with that of Hnamte *et al.*, (2013).

Maximum number of umbels per plant might be due to luxuriant vegetative growth, more number of branches per plant, broader leaf area and least number of days taken to 50 per cent flowering.

**Table.1** Effect of integrated nutrient management on plant height (cm) in coriander cultivars at different growth stages

Fertilizers / Treatments(F)	Plant Height (cm)											
	30 DAS			60 DAS			90 DAS			At Harvest stage		
	V <sub>1</sub>	V <sub>2</sub>	Mean	V <sub>1</sub>	V <sub>2</sub>	Mean	V <sub>1</sub>	V <sub>2</sub>	Mean	V <sub>1</sub>	V <sub>2</sub>	Mean
F <sub>1</sub>	8.40	9.80	9.10 <sup>d</sup>	39.40	40.33	39.87 <sup>e</sup>	69.50	70.20	69.85 <sup>e</sup>	72.50	73.13	72.82 <sup>e</sup>
F <sub>2</sub>	11.77	13.07	12.42 <sup>ab</sup>	49.00	54.33	51.67 <sup>b</sup>	85.33	91.33	88.33 <sup>b</sup>	88.33	94.33	91.33 <sup>b</sup>
F <sub>3</sub>	12.70	13.17	12.93 <sup>a</sup>	52.00	56.50	54.25 <sup>a</sup>	88.17	94.67	91.42 <sup>a</sup>	91.17	97.67	94.42 <sup>a</sup>
F <sub>4</sub>	10.43	11.10	10.77 <sup>c</sup>	42.00	46.40	44.20 <sup>d</sup>	73.33	79.60	76.47 <sup>d</sup>	76.33	82.60	79.47 <sup>d</sup>
F <sub>5</sub>	10.90	11.63	11.27 <sup>bc</sup>	44.00	48.70	46.35 <sup>c</sup>	76.00	82.83	79.42 <sup>c</sup>	79.00	85.83	82.42 <sup>c</sup>
Mean	10.84	11.75		45.28 <sup>b</sup>	49.25 <sup>a</sup>		78.47 <sup>b</sup>	83.73 <sup>a</sup>		81.47 <sup>b</sup>	86.71 <sup>sa</sup>	
	SEm ±	CD at 5%		SEm ±	CD at 5%		SEm ±	CD at 5%		SEm ±	CD at 5%	
Fertilizers(F)	0.49	1.46		0.51	1.51		0.75	2.21		0.75	2.23	
Varieties(V)	0.31	NS		0.32	0.95		0.47	1.40		0.47	1.41	
(V × F)	0.69	NS		0.72	2.13		1.05	3.13		1.06	3.15	

**Table.2** Effect of integrated nutrient management on number of secondary branches per plant in coriander cultivars at Different growth stages

Fertilizers / Treatments(F)	Number of secondary branches per plant											
	30 DAS			60 DAS			90 DAS			At Harvest stage		
	V <sub>1</sub>	V <sub>2</sub>	Mean	V <sub>1</sub>	V <sub>2</sub>	Mean	V <sub>1</sub>	V <sub>2</sub>	Mean	V <sub>1</sub>	V <sub>2</sub>	Mean
F <sub>1</sub>	4.37	4.40	4.38 <sup>d</sup>	8.00	8.50	8.25 <sup>d</sup>	10.10	10.50	10.30 <sup>d</sup>	12.00	12.50	12.25 <sup>e</sup>
F <sub>2</sub>	5.00	5.20	5.10 <sup>ab</sup>	10.40	12.30	11.35 <sup>b</sup>	12.40	14.30	13.35 <sup>b</sup>	14.40	16.30	15.35 <sup>b</sup>
F <sub>3</sub>	5.13	5.30	5.22 <sup>a</sup>	11.20	14.30	12.75 <sup>a</sup>	13.20	16.30	14.75 <sup>a</sup>	15.20	18.30	16.75 <sup>a</sup>
F <sub>4</sub>	4.53	4.70	4.62 <sup>c</sup>	8.80	9.40	9.10 <sup>cd</sup>	10.80	11.40	11.10 <sup>cd</sup>	12.80	13.40	13.10 <sup>cd</sup>
F <sub>5</sub>	4.67	4.80	4.73 <sup>bc</sup>	9.10	9.70	9.40 <sup>c</sup>	11.10	11.70	11.40 <sup>c</sup>	13.10	13.70	13.40 <sup>c</sup>
Mean	4.74	4.88		9.50 <sup>b</sup>	10.84 <sup>a</sup>		11.52 <sup>b</sup>	12.84 <sup>a</sup>		13.50 <sup>b</sup>	14.84 <sup>a</sup>	
	SEm ±	CD at 5%		SEm ±	CD at 5%		SEm ±	CD at 5%		SEm ±	CD at 5%	
Fertilizers(F)	0.08	0.23		0.33	0.98		0.28	0.84		0.26	0.76	
Varieties(V)	0.05	NS		0.21	0.62		0.18	0.53		0.16	0.48	
(V × F)	0.11	NS		0.47	1.39		0.40	1.19		0.36	1.08	

**Table.3** Effect of integrated nutrient management on leaf area (cm<sup>2</sup>) in coriander cultivars at different growth stages

Fertilizers / Treatments(F)	Leaf Area (cm <sup>2</sup> )											
	30 DAS			60 DAS			90 DAS			At Harvest stage		
	V <sub>1</sub>	V <sub>2</sub>	Mean	V <sub>1</sub>	V <sub>2</sub>	Mean	V <sub>1</sub>	V <sub>2</sub>	Mean	V <sub>1</sub>	V <sub>2</sub>	Mean
F <sub>1</sub>	26.37	27.37	26.87 <sup>c</sup>	61.40	62.40	61.90 <sup>c</sup>	64.50	65.40	64.95 <sup>c</sup>	65.50	66.80	66.15 <sup>c</sup>
F <sub>2</sub>	31.39	32.40	31.90 <sup>ab</sup>	67.50	70.80	69.15 <sup>b</sup>	70.54	74.91	72.73 <sup>b</sup>	71.25	76.91	74.08 <sup>b</sup>
F <sub>3</sub>	32.13	33.33	32.73 <sup>a</sup>	68.80	73.70	71.25 <sup>a</sup>	72.57	77.73	75.15 <sup>a</sup>	73.60	79.73	76.67 <sup>a</sup>
F <sub>4</sub>	28.80	30.05	29.43 <sup>cd</sup>	63.30	65.40	64.35 <sup>d</sup>	66.90	68.53	67.72 <sup>cd</sup>	67.40	69.60	68.50 <sup>cd</sup>
F <sub>5</sub>	29.74	30.40	30.07 <sup>c</sup>	64.50	66.90	65.70 <sup>c</sup>	67.50	69.43	68.47 <sup>c</sup>	68.50	70.10	69.30 <sup>c</sup>
Mean	29.69	30.71		65.10 <sup>b</sup>	67.84 <sup>a</sup>		68.40 <sup>b</sup>	71.20 <sup>a</sup>		69.25 <sup>b</sup>	72.63 <sup>a</sup>	
	SEm ±	CD at 5%		SEm ±	CD at 5%		SEm ±	CD at 5%		SEm ±	CD at 5%	
Fertilizers(F)	0.55	1.63		0.42	1.25		0.43	1.27		0.58	1.72	
Varieties(V)	0.35	NS		0.27	0.79		0.27	0.80		0.37	1.09	
(V × F)	0.77	NS		0.60	1.77		0.60	1.79		0.82	2.43	

**Table.4** Effect of integrated nutrient management on days taken to first and 50 per cent flowering in coriander cultivars

Fertilizers / Treatments(F)	Days taken to first flowering			Days taken to 50 per cent flowering		
	V <sub>1</sub>	V <sub>2</sub>	Mean	V <sub>1</sub>	V <sub>2</sub>	Mean
F <sub>1</sub>	50.00	49.80	49.90 <sup>c</sup>	58.20	57.30	57.75 <sup>c</sup>
F <sub>2</sub>	44.27	42.00	43.13 <sup>b</sup>	52.60	50.57	51.58 <sup>b</sup>
F <sub>3</sub>	43.00	39.00	41.00 <sup>a</sup>	52.00	47.30	49.65 <sup>a</sup>
F <sub>4</sub>	48.30	46.97	47.63 <sup>cd</sup>	56.30	54.10	55.20 <sup>cd</sup>
F <sub>5</sub>	47.30	45.90	46.60 <sup>c</sup>	55.30	53.47	54.38 <sup>c</sup>
Mean	46.57 <sup>b</sup>	44.73 <sup>a</sup>		54.88 <sup>b</sup>	52.55 <sup>a</sup>	
	SEm ±	CD at 5%		SEm ±	CD at 5%	
Fertilizers(F)	0.41	1.22		0.40	1.18	
Varieties(V)	0.26	0.77		0.25	0.75	
(V × F)	0.58	1.73		0.56	1.67	

**Table.5** Effect of integrated nutrient management on number of umbels per plant and umbellate per umbel in coriander cultivars

Fertilizers / Treatments(F)	Number of umbels per plant			Number of umbellate per umbel		
	V <sub>1</sub>	V <sub>2</sub>	Mean	V <sub>1</sub>	V <sub>2</sub>	Mean
F <sub>1</sub>	25.80	26.30	26.05 <sup>e</sup>	6.85	7.06	6.96 <sup>e</sup>
F <sub>2</sub>	31.60	34.40	33.00 <sup>b</sup>	7.74	8.28	8.01 <sup>b</sup>
F <sub>3</sub>	32.20	37.50	34.85 <sup>a</sup>	7.97	8.53	8.25 <sup>a</sup>
F <sub>4</sub>	27.30	29.20	28.25 <sup>cd</sup>	7.22	7.41	7.32 <sup>d</sup>
F <sub>5</sub>	28.40	30.50	29.45 <sup>c</sup>	7.39	7.54	7.47 <sup>c</sup>
Mean	29.06 <sup>b</sup>	31.58 <sup>a</sup>		7.43 <sup>b</sup>	7.76 <sup>a</sup>	
	SEm ±	CD at 5%		SEm ±	CD at 5%	
Fertilizers(F)	0.47	1.38		0.04	0.12	
Varieties(V)	0.29	0.87		0.03	0.08	
(V × F)	0.66	1.95		0.06	0.17	

The highest number of umbellate per umbel was due to more number of umbels per plant as compared to rest of the fertilizer level treatments. Similar results were also reported by Tripathi *et al.*, (2013), Mounika *et al.*, (2018) in coriander.

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