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RESEARCH ARTICLE

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON VEGETATIVE GROWTH, FLOWERING AND FRUITING OF CORIANDER (*CORIANDRUM SATIVUM* L.)

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ABSTRACT

An experiment was conducted to find out the effect of Integrated Nutrient Management on Vegetative Growth, Flowering and Fruiting of Coriander (*Coriandrum sativum* L.). The experiment was laid out in a randomized bloc design with 8 treatments using chemical fertilizers (NPK), vermicompost and biofertlizers (*Azotobacter* and *Phosphate Solubilising Bacteria*) in different combinations including one control treatment. The results indicated that maximum growth parameters i.e. plant height, number of branches, number of leaves, number of flowers and fruits of *Coriandrum sativum* L. was recorded in T_7 treatment compared to other treatments. From the analysis of result it can be concluded that integrated use of biofertilizers, chemical fertilizers and vermicompost treatments significantly increased growth parameters of *Coriandrum sativum* L.

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INTRODUCTION

Spices are aromatic plant products which are frequently used to enhance food palatability. The seed spices are used in whole and processed form for imparting aroma and pungency to food. They are commonly used to season the food dishes and products. In India, soil fertility is diminishing gradually due to soil erosions, loss of nutrients, and accumulation of toxic elements, water logging and unbalanced nutrient compensation. Organic manure and biofertilizers along with chemical fertilizers are the best sources to meet the nutrient requirement of crops. Integrated chemical fertilizers with organic manure have been found to be quite promising not only in maintaining higher productivity but also in crop production (Nambiar *et al*., 1989). Farm yard manure or vermicompost when integrated with reduced doses of inorganic fertilizers result in improved soil fertility, growth and yield of plant (Subbian and Palaniappan, 1992). Chemical Fertilizers have deleterious effect on soil fertility leading to unsustainable yields; while integration of chemical fertilizers with organic manures and bio-fertilizers would be able to maintain soil fertility and sustain crop productivity (Jeyabal *et al.,* 2000).

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Coriander (*Coriandrum sativum* L.), an annual herb of the parsley family (Apiaceae), is native to the Mediterranean region and is extensively grown in Bangladesh, India, Russia, central Europe and Morocco and has been cultivated since human antiquity (Small, 1997; Bhuiyan *et al*., 2009). The plant is grown widely all over the world for seed, as a spice, or for essential oil production (Lawrence, 1993). All parts of this herb are in use as flavoring agent and/or as traditional remedies for the treatment of different disorders in the folk medicine systems of different civilizations (Sahib *et al*., 2012). The seeds are also used as a flavoring agent in different foods namely pastries, cookies, buns, cakes and breads (Akgul, 1993, Coskuner and Karababa, 2007, Bhuiyan *et al*., 2009). India is the biggest producer, consumer and exporter of coriander in the world with an annual production of around three lakh tonnes. It contains an essential oil (0.03 to 2.6%) (Nadeem *et al*., 2013). Coriander is very low in saturated fat however, contains good amount of linoleic acid which is a good source of α-tocopherol and vitamin K. (Bhat *et al*., 2014). The fresh leaves of *Coriandrum sativum* L. were found to possess bactericidal activity against *Salmonella choleraesuis*. (Mohammad Altaf *et al*., 2014). Beyond these effects it is useful as an antioxidant (Misharina *et al*., 2005; Hashim *et al*., 2005), antimicrobial (Delaquis *et al*., 2002), nematicidal (Kim *et al*., 2008), antibacterial (Silva *et al*., 2011), hypoglycemic (Chitra and

Leelamma, 1999), anxyolitic (Emanghoreishi *et al*., 2005), diuretic (Assaoui *et al*., 2008) etc. Because of the utility and importance of *Coriandrum sativum* L., improving the crop productivity using organics and biofertilizers is desirable. Therefore, the present study was undertaken to study the effect of integrated nutrient management through biofertilizers (*Azotobacter, Phosphate Solubilizing Bacteria*), vermicompost, and chemical fertilizers (NPK) on vegetative growth, flowering and fruiting.

MATERIALS AND METHODS

The field experiment was conducted in farmer's field at village Raghogarh, Distt. Guna, Madhya Pradesh. The experiment was conducted in a randomized block design (RDB) With 8 treatments and three replicas of each, using chemical fertilizers (NPK), vermicompost and biofertilizers (*Azotobacter* and *Phosphate Solubilizing Bacteria*) in different combinations including one control treatment.

The treatments were T_1 - Biofertilizers (250g *Azotobacter* + 250g *PSB* ha^{-1}), T_2 - Vermicompost 5t ha^{-1}, T_3 – Chemical Fertilizers (60:30:30 kg NPK ha^{-1}), T_4 - Biofertilizers + Vermicompost (125g *Azotobacter* + 125g *PSB* + 5t vermicompost ha^{-1}), T_5 - Vermicompost + Chemical Fertilizers [5t vermicompost + 50% NPK ha^{-1} (RDF)] , T_6 - Chemical Fertilizers + Biofertilizers [50% NPK (RDF) + 125g *Azotobacter* + 125g *PSB* ha^{-1}], T_7 - Biofertilizers + Vermicompost + Chemical Fertilizers [250g bio fertilizers (125g *Azotobacter* + 125g *PSB* ha^{-1}) + 5t vermicompost ha^{-1} + 50% NPK (RDF as 30:15:15 kg per ha^{-1})], T_8 – Control (No Treatment). For recording various biometric observations, five plants were randomly selected for sampling, and tagged for recording the growth parameters. At different growth stage plant height, number of branches, number of leaves, number of flower and fruits were recorded.

RESULTS AND DISCUSSION

In the present research it was found that, at 30 DAS, maximum plant height (20.2 cm) and no. of leaves (6.8) was recorded in T_7 plot's treatment (Table-1) followed by T_6 plot's treatment, whereas no branches was seen.

Table 1. Effect of different nutrient sources on morphological parts of *Coriandrum sativum* L. at different growth stage

Plot No.	Treatment		30 DAS			60 DAS			110 (At Harvest)		
			Plant height (cm)	Number of branches per plant	Number of leaves per plant	Plant height (cm)	Number of branches per plant	Number of leaves per plant	Plant height (cm)	Number of branches per plant	Number of leaves per plant
T_1	BF		13.4	-	6.0	64.2	19.2	24.2	88.5	25.0	32.5
T_2	VC		12.5	-	4.0	62.8	18.2	19.0	78.8	20.4	20.5
T_3	CF		10.2	-	4.4	53.4	12.8	16.0	78.5	20.0	20.0
T_4	BF + VC		15.2	-	5.8	63.6	15.8	19.6	84.8	25.6	25.2
T_5	VC + CF		14.4	-	5.2	58.6	13.2	15.8	85.5	25.0	30.0
T_6	CF + BF		18.6	-	6.2	66.8	25.2	31.6	92.8	30.8	40.2
T_7	BF + VC + CF		20.2	-	6.8	67.0	26.2	32.8	95.4	31.5	40.4
T_8	Control		10.2	-	3.8	47.4	9.0	10.2	75.8	15.0	15.4
SA	Mean		14.3375	-	5.2750	60.4750	17.4500	21.1500	85.0125	24.1625	28.0250
SA	SD		3.62095	-	1.10551	6.92980	6.02447	7.89484	7.03937	5.56518	9.36326
SA	SE_m		1.28020	-	.39086	2.45005	2.12997	2.79125	2.48879	1.96759	3.31041
	95% confidence interval of the difference	Lower	11.3103	-	4.3508	54.6815	12.4134	14.5497	79.1274	19.5099	20.1971
SA		Upper	17.3647	-	6.1992	66.2685	22.4866	27.7503	90.8976	28.8151	35.8529

Table 2. Effect of different nutrient sources on flowering of *Coriandrum sativum* L. at different growth stage

Plot No.	Treatment		30 DAS			60 DAS			110 (At Harvest)		
			No. of Comp. Umbel / plant	No. of umbel / Comp. Umbel	No. of flowers / Umbel	No. of Comp. Umbel / plant	No. of umbel / Comp. Umbel	No. of flowers / Umbel	No. of Comp.Umbel / plant	No. of umbel / Comp.Umbel	No. of flowers / Umbel
T_1	BF		-	-	-	15.8	5.6	16.0	27.5	7.1	10.5
T_2	VC		-	-	-	15.8	4.8	15.6	18.5	5.4	9.5
T_3	CF		-	-	-	11.8	4.4	15.0	16.5	5.8	10.2
T_4	BF + VC		-	-	-	12.8	6.4	16.0	26.2	6.0	11.5
T_5	VC + CF		-	-	-	17.4	6.2	16.0	19.5	5.6	9.2
T_6	CF + BF		-	-	-	16.8	6.4	17.2	24.5	6.2	9.2
T_7	BF + VC + CF		-	-	-	25.5	6.8	18.2	28.5	7.6	8.9
T_8	Control		-	-	-	7.2	4.2	14.6	8.0	5.3	6.2
SA	Mean		-	-	-	15.3875	5.6000	16.0750	21.1500	6.1250	9.4000
SA	SD		-	-	-	5.28135	1.00854	1.15604	6.92160	.82245	1.55104
SA	SE_m		-	-	-	1.86724	.35657	.40872	2.44716	.29078	.54837
	95% confidence interval of the difference	Lower	-	-	-	10.9722	4.7568	15.1085	15.3634	5.4374	8.1033
SA		Upper	-	-	-	19.8028	6.4432	17.0415	26.9366	6.8126	10.6967

Similarly at 60 and 90 DAS maximum plant height (67.0 and 95.4), no. of branches (26.2 and 30.8) and no. of leaves (32.8 and 40.4) was recorded in T_7 plot (Table-1) followed by T_6 plot. Maximum no. of compound umbel per plant (25.5, 28.5), no. of umbel per compound umbel (6.8, 7.1) and no. of flowers

Table 3. Effect of different nutrient sources on fruiting of *Coriandrum sativum* L. at different growth stage

Plot No.	Treatment	45 DAS			75DAS			105 DAS/At Harvest		
		No. of seeds / umbel	No. of seeds / Comp. umbel	No. of seeds / plant	No. of seeds / umbel	No. of seeds / Comp. umbel	No. of seeds / plant	No. of seeds / umbel	No. of seeds / Comp. umbel	No. of seeds / plant
T_1	BF	-	-	-	7.0	34.4	210.0	10.0	46.0	248.0
T_2	VC	-	-	-	6.8	34.2	165.8	7.0	35.5	194.4
T_3	CF	-	-	-	5.8	27.6	180.4	6.5	30.8	190.2
T_4	BF + VC	-	-	-	8.4	39.4	219.0	12.5	40.5	290.0
T_5	VC + CF	-	-	-	7.2	32.6	171.2	8.2	36.0	240.0
T_6	CF + BF	-	-	-	7.4	33.6	270.2	7.6	36.4	304.0
T_7	BF + VC + CF	-	-	-	12.4	40.2	275.0	16.8	48.4	320.0
T_8	Control	-	-	-	5.5	23.0	113.0	6.4	24.5	167.0
SA	Mean	-	-	-	7.5625	33.1250	200.5750	9.3750	37.2625	244.2000
SA	SD	-	-	-	2.15535	5.67897	54.72481	3.63662	7.75480	57.08049
SA	SE_m	-	-	-	.76203	2.00782	19.34814	1.28574	2.74174	20.18100
SA	95% confidence interval of the difference Lower	-	-	-	5.7606	28.3773	154.8239	6.3347	30.7793	196.4795
	Upper	-	-	-	9.3644	37.8727	246.3261	12.4153	43.7457	291.9205

Abbreviations:- NT - No Treatment, BF - Biofertilizers, VC - Vermicompost, CF- Chemical Fertilizers, SD- Standard Deviation, SEm - Standard Error mean, SA - Statistical Analysis, INM - Integrated Nutrient Management, N - nitrogen, P - phosphorus, K- Potassium, PSB - phosphate solubilizing bacteria.

per umbel (18.2, 8.9) were also recorded in T_7 plot (Table-2) followed by T_6 plot's treatment. At 75 DAS and 105/at harvest stage maximum number of seeds per umbel (8.4, 16.8), number of seeds per compound umbel (40.2, 48.4) and number of seeds per plant (275.0, 320.0) were also recorded in T_7 plot (Table-3) followed by T_6 plot. The present study reveals that maximum growth of vegetative and reproductive parts of plant increases in T_7 plot compare to other plots. Same results has been already reported by Islam *et al*., 2013 in BRRIdhan 29, Meena *et al*., 2009 in ajowan (*Trachyspermum ammi* Sprague), Mehta *et al*., 2010 in fenugreek, Kabir *et al*., 2011 in turmeric, Nair and Chandra, 2001 in nutmeg. Similar finding was also reported by Hnamte *et al*., 2013 in Coriander. Good soil fertility management ensures adequate nutrient availability to plant and improve their growth. Only inorganic fertilizers can't sustain plant growth of land under modern farming. Likewise, nutrient supply through organic manures or biofertilizers can hardly fulfill the need of a plant.

Conclusion

From the above results it may be stated that the use of bio-fertilizers, chemical fertilizers along with vermicompost in integrated manner is beneficial in improving the growth of *Coriandrum sativum* L.

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