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RESEARCH ARTICLE :

Comparison between different fertilization sources, and their combinations on the growth and yield of Coriander (*Coriandrum sativum* L.)

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SUMMARY : An experiment was conducted during winter season of 2012-13 at College of Agriculture JNKVV, Jabalpur, Madhya Pradesh to assess the effect of different organic manures and inorganic fertilizer levels on growth and yield of coriander (*coriandrum sativam*). Among the organic manures and fertilizer levels, variation in morphological characters (*viz*.., plant height at 30, 60 and 90 DAS, number of primary and secondary branches per plant) were found to be significant. The maximum values were recorded with Poultry manure @ 5 t ha^{-1} and 100 % RDF repectively. Variation in treatment combinations due to interaction effect was significant (except for number of primary and secondary branches per plant) and the maximum values were recorded with Poultry manure @ 5 t ha^{-1} + 100 % RDF. Days taken to first and 50 % flowering were significantly influenced due to organic manures and fertilizer levels. FYM @ 2.5 t ha^{-1} and 50% RDF showed early first and 50 % flowering. Interaction of both the nutrient sources *i.e*. organic manures and inorganic fertilizers responded well in terms of growth and yield. It is concluded that the application of poultry manure @ 5 t ha^{-1} + 100 % recorded the maximum seed yield (19.16 q per ha) of coriander variety JD-1.

KEY WORDS :
Coriander, Growth, Inorganic fertilizer, Organic manure, RDF, Yield

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BACKGROUND AND OBJECTIVES

India is known as 'Home of Spices' and a large number of cultivating varieties of spices are being grown in different part of the country. Most of the spices are grown from Jammu and Kashmir to Kanya Kumari, since several centuries so far, one hundred ten spices have been identified and out of them 75 per cent varieties of spices are being grown alone in this spice land. Coriander is one of the important spice crop grown throughout the world and botanically known as *Coriandrum sativum* Linn. It belongs to the family Apiaceae. It is mainly cultivated for its leaves as well as seeds. The productivity of Coriander is influenced by several factors such as soil, varieties, fertilizer management, and also various agro techniques used for growing crop. Nutrients play a vital role in

functioning of normal physiological processes during the period of growth and development of a plant. However, for obtaining higher economic yield, balanced supply of nutrients is one of the key factors (Singh, 1976). India has been spending billions of dollars every year for the import of chemical fertilizer previously. The use of chemical fertilizers contribute a lot in fulfilling the nutrient requirement of crops but the regular, excessive and unbalanced application of chemical fertilizers deteriorate the physico-chemical properties of the soil and quality of product and ultimately poor crop yield. Therefore, the present study was undertaken to evaluate the influence of organic manures and inorganic fertilizer doses of nutrients on growth parameters and yield of coriander.

RESOURCES AND METHODS

The experiment was carried out at during the *Rabi* season at Horticulture complex, Department of Horticulture, JNKVV, Jabalpur (M.P.) during the year 2012-2013. The experiments were laid out in Asymmetrical Factorial RCBD with three replications. The well decomposed FYM and Poultry manure were applied in the treatment plots before sowing of seeds. It was mixed well in each plot by light ploughing. The chemical fertilizers were applied manually at the time of sowing. Nitrogen was supplied through Urea, phosphorus through SSP and potash through Muriate of potash @ 50:30:60 kg/ha in plots of RDF@ 100% and 25:15:30 in plots of RDF@ 50 %. Half amount of N with full amount of P and K were given per plot as basal dose and rest amount of N was given as top dressing after 40 days of sowing. Prior to sowing seeds were splited into two halves by rubbing, besides seeds were treated with thiram @ 2 g/kg of seeds was done thoroughly against seed borne diseases. Seeds were sown in line by maintaining 30 x 10 cm spacing. The thinning and weeding operations were done at 30 days of sowing in order to maintain the plant population as per spacing. All the cultural operations were done as and when required for good stand of the crop. Irrigation and other operations were done as per operation schedule. Due to large population of plants in the plots, it was rather difficult to record the observation in each plant in the experiment field. Since, all the plants have equal opportunity for their growth and development. Therefore, a technique of random sampling was adopted and a sample of five plants from each plot was drawn at random to record the growth attributes as well as yield and yield attribute. The observations of plant were recorded at regular interval throughout their life cycle to measure the course relationship between growth attributes and attributes at harvest.

OBSERVATIONS AND ANALYSIS

The result pertaining to the analysis of variance for the experimental design is reported in the below tables. The Anova revealed that there existed significant difference among the treatments for all characters studied when analysed statistically. The height of coriander plant at 30, 60 and 90 DAS was influenced significantly by the use of various treatments of organic manures. It was observed that among the organic manures, Poultry manure 5 @ t ha $^{-1}$ recorded the maximum plant height (13.37, 70.30 and 91.92 cm respectively) followed by Poultry manure 2.5 @ t ha $^{-1}$ (11.47, 69.24 and 91.02 cm respectively) while, the minimum height was recorded with FYM @ 10 t ha $^{-1}$ (11.06, 66.47 and 87.31cm respectively).The result might be due to the proper supply of macro- and micro-nutrients. The present findings are in conformity to Moslemi *et al*. (2012), Darzi *et al*.(2012 a&b) in anise, and Asgharipour (2012) in cumin.

Table 1 : Effect of organic manures (OM) and fertilizers (RDF) on plant height of coriander at 30, 60 and 90 das

Organic manures	Plant height (cm) 30 DAS			Plant height (cm) 60 DAS			Plant height (cm) 90 DAS		
	RDF 100 %	RDF 50 %	Mean	RDF 100 %	RDF 50 %	Mean	RDF 100 %	RDF 50 %	Mean
FYM @ 20 t/ha	13.22	11.30	11.26	70.18	67.13	68.66	91.32	86.48	88.90
FYM @ 10 t/ha	11.91	10.20	11.06	68.07	64.87	66.44	89.21	85.41	87.31
Poultry manure @ 5 t/ha	14.78	11.96	13.37	71.22	69.48	70.35	94.70	89.16	91.92
Poultry manure @ 2.5 t/ha	12.48	10.45	11.47	70.09	68.39	69.24	93.87	88.17	91.02
Mean	12.93	10.98	11.77	69.89	67.45	68.67	92.28	87.30	89.78
	OM	RDF	OM × RDF	OM	RDF	OM × RDF	OM	RDF	OM × RDF
S.E. ±	0.18	0.13	0.25	00.20	00.14	00.28	00.18	00.13	00.26
C.D. (P=0.05)	0.541	0.383	1.135	00.610	00.431	01.280	00.559	00.396	01.174

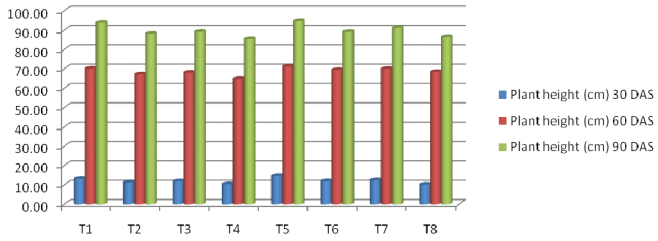

Fig. 1 : Bar graph for plant height at 30, 60 and 90 DAS

Variation in plant height with regard to fertilizer levels was observed significant and the maximum height was found with 100 % RDF (12.93, 69.89 and 92.28 cm respectively) and the minimum with 50 % RDF (10.98, 67.45 and 7.30 cm respectively). The present finding is in agreement with the findings of Singh and Jat (2002); Kumar *et al*. (2007); Nagar et al.(2009) and Khalid (2012.) there was significant difference for plant height due to interaction effect among the treatment combinations, the maximum height was recorded with Poultry manure @ 5 t ha $^{-1}$ + 100 % RDF (14.78, 71.22and 94.70 cm respectively) followed by FYM @ 20 t ha $^{-1}$ + 100% RDF (13.22,70.18 and 93.87 cm respectively) and the minimum with FYM @ 10 t ha $^{-1}$ + 50% RDF (10.20, 64.87 and 85.41 cm respectively). The higher plant height achieved might be owing due to combined application of major and minor nutrients, through different organic and inorganic fertilizers levels which resulted in fast cell division, multiplication and cell elongation in meristematic region of the plant. The present finding is in conformity to Singh (2011).

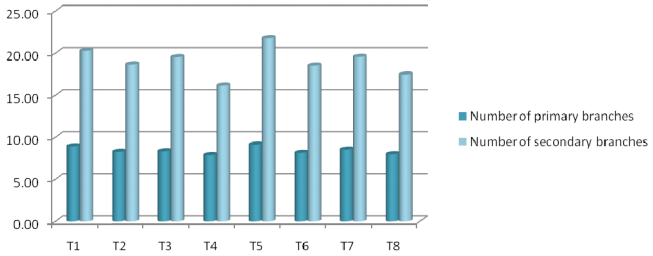

Fig. 2 : Bar graph for number of primary and secondary branches per plant of coriander

Number of primary and secondary branches per plant were influenced significantly with regard to organic manures. It was observed that the maximum number of primary and secondary branches were recorded by the application of Poultry manure @ 5 t ha $^{-1}$ (8.63 and 20.17 respectively) followed FYM @ 20 t ha $^{-1}$ (8.60 and 19.48 respectively).While the lowest number of primary and

Table 2 : Effect of organic manures and fertilizers on number of primary and secondary branches per plant of coriander

Organic manures	Number of primary branches/plant			Number of secondary branches /plant		
	RDF 100 %	RDF 50 %	Mean	RDF 100 %	RDF 50 %	Mean
FYM @ 20 t/ha	8.93	8.27	08.600	20.30	18.67	19.483
FYM @ 10 t/ha	8.33	7.87	08.100	19.53	16.13	17.833
Poultry manure @ 5 t/ha	9.13	8.13	08.633	21.80	18.53	20.17
Poultry manure @ 2.5 t/ha	8.53	7.97	08.250	19.57	17.47	18.52
Mean	08.733	08.058		20.30	17.70	
	OM	RDF	OM × RDF	OM	RDF	OM × RDF
S.E. ±	00.079	00.056	-	00.32	00.23	-
C.D. (P=0.05)	00.240	00.170	NS	00.982	00.694	NS

NS= Non-significant

Table 3 : Response of organic manures and fertilizerss days taken to first and 50 % flowering of coriander

Organic manures	Days taken to first flowering			Days taken to 50 % flowering		
	RDF 100 %	RDF 50 %	Mean	RDF 100 %	RDF 50 %	Mean
FYM @ 20 t/ha	52.33	50.67	51.500	59.67	57.67	58.667
FYM @ 10 t/ha	51.67	47.67	49.67	59.33	55.67	57.500
Poultry manure @ 5 t/ha	56.67	53.33	55.000	65.33	62.67	64.000
Poultry manure @ 2.5 t/ha	56.33	52.67	54.500	64.33	61.33	62.833
Mean	54.25	51.08		62.17	59.33	
	OM	RDF	OM × RDF	OM	RDF	OM × RDF
S E. ±	00.24	00.17	00.34	00.23	00.17	-
C.D. (P=0.05)	00.721	00.510	01.514	00.709	00.501	NS

NS=Non-significant

secondary branches were recorded with FYM @ 10 t ha $^{-1}$ (8.10 and 17.83 respectively**).** The effect of fertilizer levels was also observed to be significant and the maximum number of primary and secondary branches were found with 100 % RDF (8.73 and 20.30 respectively) and the minimum in 50 % RDF (8.05and 17.70 respectively). The present finding is in conformity to Singh and Jat (2002); Channabasavanna *et al.* (2002); Kumar *et al.* (2007); Nayak *et al.* (2009) and Khalid (2012). But their was no significant difference with regard to interaction effects. However, Poultry manure @ 5 t ha $^{-1}$ + 100 % RDF (9.13 and 21.80 respectively) recorded the maximum number of primary and secondary branches followed by FYM @ 20 t ha^{-1} + 100% RDF (8.93and 20.30 respectively) and the minimum were found with the application of FYM @ 10 t ha $^{-1}$ + 50% RDF (7.87 and 16.13 respectively). Probable reason for increased number of branches might be due to the increased rates of photosynthesis and photosynthates. This character is also found to be related with endogenous hormonal level and apical dominance in the plant. The findings are in close harmony with the results of Singh and Prasad (2006).

Day to first flowering and for 50 % flowering was significantly influenced by the use of various organic manures. Early first flowering and 50 % flowering was observed in FYM @ 10 t ha $^{-1}$ (49.67 and 57.50 days respectively) followed by FYM @ 20 t ha $^{-1}$ (51.50 and 58.67 days respectively) and late with Poultry manure @ 5 t ha $^{-1}$ (55 and 64 days respectively). With regard to fertilizer levels, early first flowering and 50 % flowering was observed in 50 % RDF (51.08 and 59.33 days respectively) and delayed flowering in 100 % RDF (54.25 and 62.17 days respectively). Further, variation for days taken to first flowering significantly influenced by various treatment combinations but variation for days taken to 50 % flowering was nonsignificant among the treatment combinations, however, application of FYM @ 10 t ha -

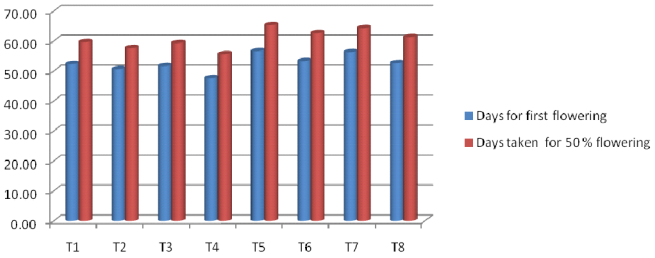

Fig. 3 : Bar graph for days to first and 50 % flowering of coriander

Table 4 : Effect of organic manures and fertilizer on number of umbels per plant and seed yield per plant (g) of coriander

Organic manures	Number of umbels per plant			Seed yield per plant (g)		
	RDF 100 %	RDF 50 %	Mean	RDF 100 %	RDF 50 %	Mean
FYM @ 20 t/ha	32.67	30.73	31.700	5.78	4.50	5.14
FYM @ 10 t/ha	32.10	29.03	30.57	4.89	3.62	4.25
Poultry manure @ 5 t/ha	36.27	31.07	33.67	7.14	5.04	6.09
Poultry manure @ 2.5 t/ha	33.33	30.73	32.033	6.27	4.13	5.20
Mean	33.61	30.39		06.018	04.322	
	OM	RDF	OM × RDF	OM	RDF	OM × RDF
S.E. ±	00.29	00.20	00.40	00.215	00.152	-
C.D. (P=0.05)	00.867	00.613	01.818	00.651	00.461	NS

NS=Non-significant

Table 5 : Effect of various levels of organic manures and fertilizers on seed yield per plot (kg) and seed yield per hectare (q) of coriander

Organic manures	Seed yield per plot (kg)			Seed yield per hectare (q)		
	RDF 100 %	RDF 50 %	Mean	RDF 100 %	RDF 50 %	Mean
FYM @ 20 t/ha	1.90	1.59	01.74	17.81	14.89	16.35
FYM @ 10 t/ha	1.72	1.27	01.49	16.14	11.90	14.02
Poultry manure @ 5 t/ha	2.04	1.65	01.85	19.16	15.43	17.30
Poultry manure @ 2.5 t/ha	1.82	1.52	01.67	17.08	14.20	15.64
Mean	01.871	01.504		17.55	14.11	
	OM	RDF	OM × RDF	OM	RDF	OM × RDF
S.E. ±	00.017	00.012	00.024	0.16	0.11	0.22
C.D. (P=0.05)	00.052	00.037	00.109	00.472	00.333	00.989

^{1} + 50% RDF (47.67 and 55.67 days respectively) recorded early first and 50 % flowering followed by FYM @ 20 t ha $^{-1}$ + 50% RDF (50.33 and 57.67 days respectively) while, late flowering was observed with Poultry manure @ 5 t ha $^{-1}$ +100 % RDF (56.67 and 65.33 days respectively). The variation in number of days to flowering might be due to the fact that nitrogen in plants increased cell division and cell differentiation. Thus, plant remains in vegetative phase and results in imbalance between C: N ration there by leading to delayed flowering at higher nitrogen levels. The findings are in agreement with findings of Verma *et al.* (1991); Ram and Verma (2000) and Subramanian and Vijayakumar (2001) in fenugreek.

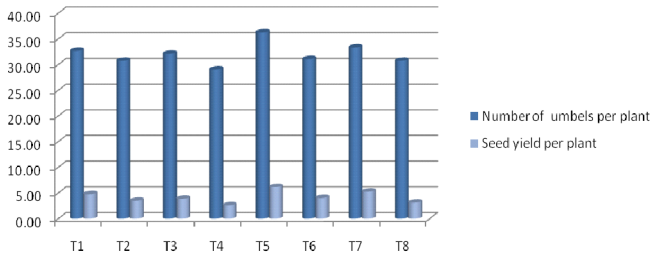

Fig. 4 : Bar graph for number of umbels per plant and seed yield per plant (g) of coriander

The application of organic manures significantly improves the various yield parameters and consequently yield *viz*.., number of umbels per plant,, seed yield per plant (g), seed yield per plot (kg) and seed yield per hectare (q) of coriander. Number of umbels per plant of coriander were significantly affected by various organic manures. Among the organic manures, Poultry manure @ 5 t ha $^{-1}$ (33.67) produced the maximum number of umbels per plant, while the least in FYM @ 10 t ha $^{-1}$ (30.57). The present findings are in accordance with Ibrahim *et al.*(2006) and El- Mekawey *et al.* (2010). There was significant difference with regard to application of fertilizer levels also. The maximum number of umbels per plant were observed in the application of 100 % RDF (33.61) and the minimum in 50 % RDF (30.39). The present findings are in accordance with Singh and Jat (2002) ; Okut and Ydrm (2005); Kumar *et al.* (2007); Nagar *et al.*(2009); Nayak *et al.* (2009); Jan *et al.*(2011) and Khalid (2012). Further, there was significant difference among the treatment combinations due to interaction effect. The maximum number of umbels per plant were recorded with the application of Poultry manure @ 5 t ha $^{-1}$ + 100 % RDF (36.27) while, the least number of umbels per plant were recorded in FYM @ 10 t ha $^{-1}$ + 50% RDF (29.03). The present findings corroborated the results of Choudary *et al* (2011) for number of pods per plant in fenugreek. The increase in number umbels per plant might be due to increased supply of major plant nutrients that are required in larger quantities for growth and development of plants. Nitrogen accelerates the growth, development reproductive phases and protein synthesis in plants, thereby promoting higher number of umbels per plant.

Seed yield per plant (g) was influenced significantly by the use of various organic manures. Poultry manure @ 5 t ha $^{-1}$ (6.09 g) produced the maximum seed yield per plant whereas, the minimum seed yield per plant was recorded in FYM @ 10 t ha $^{-1}$ (4.25 g). The present findings are in accordance with El- Mekawey *et al.* (2010). Seeds yield per plant (g) was significantly influenced by fertilizer levels. The highest seed yield per plant were recorded in 100 % RDF (6.02g) and mimimum in 50 % RDF (4.32g). 100 % RDF was observed to be significant over 50 % RDF. The present findings are in accordance with Manure *et al.*(2000) ; Kumar *et al.* (2007); Nayak *et al.* (2009) and Khalid (2012) but the interaction effect was not significant, however, the maximum seed yield per plant (g) was recorded in Poultry manure @ 5 t ha $^{-1}$ + 100 % RDF (7.14g) and the minimum seed yield per plant was recorded in FYM @ 10 t ha $^{-1}$ + 50% RDF (3.62 g)

Seed yield per plot (kg) and seed yield per hectare (q) was influenced significantly by the use of various organic manures, among the organic manures, Poultry manure @ 5 t ha $^{-1}$ produced the maximum seed yield per plot (1.85 kg) and seed yield per hectare (17.30 q). The least seed yield per plot (1.49 kg) and seed yield per hectare (14.02 q) was noted in FYM @ 10 t ha $^{-1}$. There was significant difference for seed yield with regard to fertilizer levels. The maximum seed yield was found in 100 % RDF (1.87 kg/plot and 17.6 q/ha) and the minimum in 50 % RDF (1.5 kg/plot and 14.1 q/ha). Similar results are reported by Manure *et al.*(2000); Naghera *et al.* (2000); Singh *et al.* (2000); Singh and Jat (2002); Channabasavanna (2002); Kumar *et al.* (2002); Garg *et a*l.(2004); Gujar *et al.*(2005); Tripathi (2006 a&b); Akbarinia *et al.* (2006); Oliveira *et al.* (2006) Kumar *et al.* (2008) and Nagar *et al.* (2009). Based on the interaction effects maximum seed was recorded with Poultry manure @ 5 t ha $^{-1}$ + 100 % RDF (2.04 kg/plot and 19.16 q/ha). While the minimum seed yield (1.27 kg/

plot and (11.90 q/ha) was recorded in FYM @ 10 t ha $^{-1}$ + 50% RDF. Similar results have also been reported by Mohamed and Abdu (2004); Sadanandan and Hamza (2006) in black pepper. Aishwath *et al*. (2010); Choudary *et al*. (2011) in fenugreek and Jan *et al*. (2011). The probable reason for enhanced seed yield might be due to cumulative effects of nutrient (macro and micro) on vegetative growth which ultimately led to more photosynthetic activities while, application of organic and inorganic enhance carbohydrate and nitrogen metabolism of pectic substances, as well as improve the water metabolism and water relation in the plants. From the above result it can be concluded that i**n** case of organic manures, the application of Poultry manure @ 5 t ha^{-1} and among the fertlilizer levels the application of 100 % RDF was significantly superior to seed yield and its attributing characters. Interaction of both the nutrient sources *i.e.* organic manures and inorganic fertilizers responded well in terms of growth and yield. It is concluded that the application of poultry manure @ 5 t ha^{-1} + 100 % recorded the maximum seed yield (19.16 q per ha) of coriander variety JD-1.

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