Assessment of different fertilizer levels on growth and yield of coriander. *(Coriandrum sativum L.)* cv- JD-1.

ABSTRACT

Using chemical fertilizers or organic manures alone as amendments may be detrimental to the soil health and crop quality and neither of these alone can sustain productivity. Hence the combination of these nutrients together with optimum ratio is a way forward to achive optimum yield and soil health. In view of this a trial was conducted in coriander cv- JD-1 over winter 2012-13 at Jawaharlal Nehru krishi Vishwa Vidyalaya , Jabalpur, Madhya Pradesh to evaluate the effect of organic manures and chemical fertilizers with different levels on growth and yield parameters of coriander. The experiment consists of four levels of organic manures viz vermicompost 5 t/h, vermicompost 2.5 t/h, FYM 20 t/h and FYM 10 t/h with two fertilizer levels 100 % RDF and 50 % RDF laid out in a randomized block design replicated thrice.The study shows that among the organic manures vermicompost @ 5 t/h and among the fertilizer levels RDF 100 % showed maximum values for growth and yield parameters comparison to other levels of manures and fertilizer. Results in relation to interaction effect shows that vermicompost 5 t/h + 100 % RDF was superior over other treatment combinations . Highest gross income were observed with vermicompost 5 t/h + 100 % RDF and highest benefit cost ratio with farm yard manure 20 t/h + 100 % RDF.

Key words: Coriander, seed yield, economic returns, organic manures and fertilizers.

INTRODUCTION

Coriander is an annual herb and a member of the Apiaceae (Parsley) family and genus *Coriandrum* (Sharma et al., 2012; Khan, 2019). There are only two known species of this genus which includes the cultivated plant*C. sativum* L. and its wild relative *C. tordylium*. Coriander is originated from the Eastern Mediterranean region and is widely cultivated in Russia, Central Europe, North Africa and Asia (Singh et al., 2006; Sriti et al., 2009a, 2009b). Coriander is important and most

commonly used spices (Leena *et al*., 2012), occupying a prime position throughout the globe to add taste and flavor in various food items. Coriander can refer to both herb and spice. Herbs are the fresh, leafy part of a plant (JSS, 2018) used in culinary to add flavour or as a medicine. Spices come from the seeds, root or bark of the plant and are considered any edible part of the plant, besides the leaf, that can be used for seasoning; some plants have both. Therefore, most of the time cilantro refers to the leaves while coriander is to indicate the seeds. Cilantro leaves and coriander seeds have different taste and cannot be substituted for each other. (Bhat et al., 2014, Filippone, 2018). Coriander is essential component in the preparation of ayurvedic medicines and traditional home therapies for different ailments (Emamghoreishi *et al*., 2005).Seeds contains high amount of minerals and essential oils which could be exploited for the preparation of medicinal combatants against several acute and chronic diseases (Sharma et al., 2012; Khan, 2019).

Production of coriander continues to be constrained by a number of factors that can reduce yield quantity and quality like other crops (Wang et al., 2013). Among those factors, fertilizer management has considerable practical importance. Fertility status of the soil can be reduced due to leaching, exporting, mineralization, immobilization or other means. Therefore, extensive fertilizer applications are required to meet the crop demand of nutrients to obtain good return (Reetz, 2016). However, continuous application of suboptimal doses of fertilizers may leads to depletion of nutrient reserves in the soil. In general, agro-environmental problems are not limited to the use of chemical fertilizers only but also occur with organic fertilizers. Both organic and chemical fertilizers have the potential of environmental pollution. Inorganic fertilizers accumulate salt which expends more energy to draw water from the soil and cause plants to appear wilted or dried out and if there is a rainfall shortly after applied, fertilizers wash away and

can pollute streams, ponds and other water bodies. It can also leach away from the root zone of plants. It may enter through plant to the food chain and they get accumulated and harm human health (Sharma and Chetani, 2017). However organic fertilizers are environmentally eco-friendly when compared to inorganic fertilizers (Chauhan *et al*., 2012; Ahmad et al., 2017). But, intensive use of organic fertilizers alone can affect physico-chemical properties of the soil which results in decreased soil fertility status (Chauhan *et al.*, 2012). Continues application of organic fertilizers will increase levels of soil nutrients, could cause a buildup of some nutrients, and loss of nutrients to the environment. In addition, decomposition of organic material is strongly affected by temperature and soil moisture thus nutrients may be released when plant does not need them. Only a limited amount of organic material is available and it is generally difficult to meet crop nutrient demands through organic fertilizers alone. This implies that crops can suffer initial starvation from nutrient immobilization prior to mineralization (Sharma and Chetani, 2017). To meet the entire crop nutrient requirement, different fertilizer types have to be applied in an integrated manner, as applying of single dose of nutrient can't fulfil the crop nutrient demands (Mahajan and Gupta, 2009). Rather, there is a need to be used in an integrated manner following a management technology which is practicable, economically viable, socially acceptable, and ecologically sound (Mahajan and Gupta, 2009). Therefore, present study was taken to develop a suitable nutrient management practice for coriander crop adopting organic manures.

MATERIALS AND METHODS

An open field experiment was conducted during the winter seasons (Rabi) of year 2012-2013at Horticulture complex, Department of Horticulture, Jawaharlal Nehru

krishi Vishwa Vidyalaya , Jabalpur, Madhya Pradesh. The experimental site falls on 23.9^0N latitude and 79.58^0E longitudes with an altitude of 411.8 m above the mean sea level. Geographically, Jabalpur falls under “Kymore Plateau and Satpura Hills” agro climatic region of M.P. It is situated in the semi-arid region having sub-tropical climate with hot dry summer,and cold winter. The average rainfall of about 1375 mm, which is mainly distributed from mid June to September. The average temperature ranges between 46.6^0C and 21^0C. The mean relative humidity reaches up to78%during winter (November- February) with occasional frost. The Design of experiment was Randomized complete block design (RCBD) with 3 replications. The experiment consisted of 8 treatments. Viz fertility levels 100% RDF (N50P30K60 kg /ha) and 50 % RDF (N25P15K30 kg/ha) in combinations with vermicompost 5 t/ha , vermicompost 2.5 t/ha, FYM 20 t/ ha and FYM 10 t/ha,. Proper leveling was done in order to facilitate the irrigation. Layout of the experiment was done as per plan of the investigation and treatments were given. The well decomposed FYM and vermicompost was applied in required plots before sowing of seeds. It was mixed well in each plot by light ploughing. 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 coriander variety JD-1 seeds were splited into two halves by rubbing seeds were treated with thiram @ 2 g/kg of seeds was done thoroughly against seed borne diseases. The sowing of seeds was done as per treatments in prepared plots. Seeds were sown at 30 cm row spacing apar. The first light irrigation was provided just after sowing and subsequent irrigations were given at 15-20 days intervals to maintain the soil moisture till crop maturity. All the cultural operations were done as and when required for good crop stand. Other operations were done as per operation schedule. 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 data on various parameters. The experimental data was analysed statistically by the method of analysis of variance as out lined by Panse and Sukhatme (1985). To find out the economic feasibility of various treatment combinations, economics of the various treatments were worked out by calculating parameters like cost of cultivation, gross returns, net returns and benefit cost ratio using the prevailing price of inputs and outputs in local market.

RESULT AND DISCUSSION.

Effect of Organic manures on Growth and Yields of Coriander.

The study have shown that the application of organic manures significantly improves the various growth and yield parameters.The maximum plant height (14.55cm, 70.97cm and 93.17cm) at 30, 60 and 90 DAS, primary branches per plant (9.07) and secondary branches per plant (21.86), first flowering(52.3 days)and 50 % flowering (61.50 days),umbels per plant (32.33), umbellets per umbel (6.82), seeds per umbel (32.52), weight of seeds per umbel (0.43), seeds per plant (550.44), seed yield per plant (5.53g), seed yield per plot (1.82kg) and seed yield per hectare (17.07q) were recorded from plants received vermicompost 5 t/ ha in comparison to other levels of organic manures. However, the minimum plant height (11.18cm, 66.47cm and 87.31cm) at 30, 60 and 90 DAS, primary branches per plant (8.10) and secondary branches per plant (17.83), first flowering (49.67 days) and 50 % flowering (57.50 days), umbels per plant (30.57), umbellets per umbel (6.37), seeds per umbel (29.88), weight of seeds per umbel (0.37), seeds per plant (488.54), seed yield per plant (4.25g), seed yield per plot (1.49kg) and seed yield per hectare (14.02q) with FYM 10 t/ha. These growth responses were most

probablydue to the production of plant growth substances and other growth promoting substances by vermicompost applications the metabolic process of the plant gets stimulated including increased uptake of nutrients through insoluble nutrient like P gets converted in to soluble nutrients by the activation of desirable enzymes. It's reported that vermicompost is rich in nutrients like O, C, N, P, K, Ca, Mg, Fe, Zn, Cu, Mn and Br when compared to farmyard manure. Utilization of vermicompost is the most excellent means of reducing environmental pollution, soil degradation and removal in discriminate use of chemical fertilizers. Literature stated that organic fertilizer can influence different attributes of coriander crop. It can influence production through adding nitrogen to the soil (legumes), nitrogen conservation (by reducing leaching) and making nitrogen available to plant (Rayns and Rosenfeld, 2010). Similarly Edwards and Burrows, (1988) and Atiyeh *et al*., (2002) reported that vermicompost has a positive effect on biomass production which subsequently enhanced growth and yield parameters. Ravimycin, (2016) observed higher germination percentage (94%), root length (8.4cm), shoot length (24.8cm), plant fresh weight (16.7 g), plant dry weight (7.8g), total chlorophyll (6.8 mg.fr.wt), carotenoids (2.25 mg.fr.wt) and protein (23.32 mg.fr.wt) was recorded in vermicompost application at 90 days after sowing of coriander plant. The minimum recorded in control at 90 days after sowing of coriander plants. Dash *et al.*,(2019) observed highest leaf yield in treatment with vermicompost (12.5 t/ha) (PP with organic methods) (4.53-4.60 kg/plot).The present findings are in conformity to Moslemi *et al*. (2012), Darzi*et al*., (2012) in anise, and Asgharipour (2012) in cumin, Ibrahim *et al*., (2006) and El- Mekawey *et al*., (2010) in coriander.

Effect of Fertilizer levels on Growth and Yields of Coriander.

To standardize the rate of three major nutrients nitrogen, phosphorus and potash , studies have shown that the maximum height (13.73cm,70.15cm and 92.71cm respectively) at 30, 60 and 90 DAS, primary branches per plant (8.92) and secondary branchesper plant (21.21) ,first flowering (52.92 days) and 50 % flowering (61.00 days), umbels per plant (32.74), umbellets per umbel (6.92), seeds per umbel (32.65), weight of seeds per umbel (0.45), seeds per plant (567.28), seed yield per plant (5.65g), seed yield per plot (1.84 kg) and seed yield per hectare (17.23q) with was found with 100 % RDF and the minimum (11.75cm, 67.59cm and 87.98 cm respectively) at 30, 60 and 90 DAS, primary branches per plant (8.20) and secondary branches per plant (18.09), first flowering (50.08 days) and 50 % flowering (57.75 days), umbels per plant (30.02), umbellets per umbel (6.25), seeds per umbel (29.01), weight of seeds per umbel (0.34), seeds per plant (464.82), seed yield per plant (4.08g), seed yield per plot (1.5 kg) and seed yield per hectare (14.04q) with 50 % RDF. 100 % RDF was found to be significant over 50 % RDF. The probable reason might be due to increased supply of major plant nutrients that are required in larger quantities and cumulative effects of nutrient on growth which ultimately led to more photosynthetic activities It's that balanced fertilizer application improved the availability of phosphorous, nitrogen and other nutrients, helped in increasing the yield attributing characters (Mounika *et al*., 2018). The present finding are in propinquity with the results of Manure *et al*., (2000), Naghera *et al*., (2000); Singh *et al*., (2000); Singh and Jat (2002); Channabasavanna *et al.* (2002); Okut and Ydrm (2005) ; Gujar *et al*.,(2005); Tripathi (2006); Akbarinia *et al*., (2006); Oliveira *et al*., (2006); Kumar *et al*. (2007); Kumar *et al*., (2008) Nagar et al., (2009)); Nayak *et al.* (2009); Jan *et al.*, (2011) and Khalid (2012.). Fikadu *et al*., (2019) observed maximum number of umbels per plant (17.93), umbellate per umbel (6.69), seeds per umbel (18.34), seed yield per plant (4.01 g) seed yield per

plot (341g) and seed yield per hectare (12.36 q) with treatment N (60kg/ ha) and P (50 kg/ha) instead of highest dose of both nutrients. Javiya *et al*., (2017) experiment results revealed that application of 60 kg N/ha promoted seed yield (1483 kg/ha) and stover yield (1760 kg/ha) with higher net return (65976 ha^{-1}) and benefit cost ratio (3.48) over untreated. Conversely, frequent application of nitrogen fertilizers is likely to increase the concentration of nitrate in ground water which is detrimental to human health (Elasbah *et al*., 2019). Application of phosphorus enhanced significantly growth and yield attributes. For example, 40 kg P2O5 ha^{-1} increased seed yield (1388 kg/ha) and stover yield (1613 kg/ha) of coriander. The yield further increased with increasing level of P2O5 but could not reach up to level of significant. The maximum net realization of (61008 ha^{-1}) obtained with 60 kg P2O5 ha^{-1}, but benefit cost ratio maximum (3.26) was obtained with 40 kg P2O5 ha^{-1}. It also significantly increased content and uptake of NPK kg/ha at 60 kg N /ha and 60 kg P2O5 ha^{-1} in seed and stover (Javiya *et al*., 2017). Maintaining and keeping soil health has paramount importance for sustainability of ecosystem. The effect of long-term application of inorganic fertilizers on soil biological properties is of topical importance for up keeping soil health. Nitrogen supplying fertilizers upon hydrolysis also produce ammonium, decrease soil pH and affecting activities of those microbes (Basak *et al.,* 2017). Farming can be more profitable with higher crop yield through use of those inorganic NPK fertilizers. But, wide disparities in NPK ratio along with inability of integrated use of all sources of plant nutrients deteriorate soil health and thus nutrition of plants (Reetz, 2016). However, the continuous use or excess supply of inorganic fertilizers as source of nutrient in imbalanced proportion is also a problem, causing economic inefficiency, damage to the environment and in certain situations harm plants themselves and also to human being who consume them (Dolker *et al*., 2017).

Effect of different nutrient combinations on Growth and Yields of Coriander.

Study found that combined application of organic manure and inorganic fertilizer improve soil fertility and crop yield of coriander. The use of integrated nutrients such as vermicompost, and RDF as inorganic sources recorded the best yield of coriander.Results shows that the maximum plant height (15.98 cm, 72.23 cm and 95.69 cm) at 30, 60 and 90 DAS, the primary branches per plant(9.67) and secondary branches per plant (23.60), first flowering (52.83 days) and 50 % flowering (61.50 days) umbels per plant (34.13), umbellets per umbel (7.11), seeds per umbel (34.13), weight of seeds per umbel (0.48), seeds per plant (598.34), seed yield per plant (6.72g), seed yield per plot (1.98 kg) and seed yield per hectare (18.53q) with treatment combination vermicompost 5 /ha + 100 % RDF and the minimum plant height (10.45cm, 64.87cm and 85.4 cm) at 30, 60 and 90 DAS, primary branches per plant (7.87) and secondary branchesper plant (16.13),first flowering (49.67 days) and 50 % flowering (57.50 days) umbels per plant (29.03), umbellets per umbel (5.97), seeds per umbel (28.33), weight of seeds per umbel (0.33), seed yield per plant (3.62g), seed yield per plot (1.27kg) and seed yield per hectare (11.90q) with FYM 10 t /ha + 50 % RDF. Higher seed yield might be due to more number of umbels per plant, umbellate per umbel, seeds per umbel and maximum seed weight of this fertilizer level treatment over the others. 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. Integrated nutrient management accelerates the growth, development reproductive phases and protein synthesis in plants, there by promoting higher yield as compared to other fertilizer level treatments. Moreover, it might also be due to balanced C: N ratio, increased decomposition, mineralization, availability of native and applied macro and micro-nutrients,

resulted in accelerated carbohydrates synthesis, led to better translocation from sink to source (Singh, 2015). These findings were in consonance with the report of Verma *et al.,* (1991); Ram and Verma (2000) and Subramanian and Vijayakumar (2001) and Choudary *et al.* (2011) for number of pods per plant in fenugreek. Singh (2011) and Moslemi *et al., (*2012) in coriander. Mohamed and Abdu (2004); Sadanandan and Hamza (2006) in black pepper. Aishwath *et al*., (2010); Jan *et al.*,(2011) and Sahu *et al.*,(2014) in coriander. Tripathi *et al.,* (2013) reported that integrated nutrient management practice improved the growth and yield contributing characters in coriander. Similarly findings are in line with the Nabi *et al.*,(2018) observed maximum number of lateral branches /plant (8.50) and minimum days taken for 50% germination (19.63) was recorded by treatment with 50% nitrogen through urea and 50% nitrogen through vermicompost. Singh, (2011) reported that the solely application of vermicompost and inorganic fertilizers did not influence coriander crop rather integrated application of vermicompost (7.5 t/ha) with 25% recommended NPK (25: 12.5: 12.5 kg/ha) produced maximum biomass (28.2 q/ ha), seed (10.82 q ha) and oil yield (6.53 kg /ha) of coriander. Pooja *et al*., (2017) reported that practicing of integrated nutrient management improved the nutrient uptake, photosynthesis activity and moreover resistant to pests and diseases, ultimately resulted in more seed yieldin coriander. Similarly, A combined application of vermicompost (2.5 t/ha) with N level (40 kg /ha) and P level (20 kg/ha) significantly increased all the yield, quality and uptake parameters. This is due to improved overall growth and profuse branching due to nitrogen fertilization coupled with increased net photosynthesis on one hand and greater mobilization of photosynthates towards reproductive structures (Sanwal *et al*., 2017). Several authors have been agreed up on integrated nutrient application as it is sustainable, ecofriendly and free of contamination. Applying any fertilizer lonely cannot fulfill crop nutrient demand. The highest seed yield of coriander is

obtained when different fertilizers are combined together. Applying of inorganic fertilizers lonely have increased seed yield of coriander crop. However, the best profit is obtained when those nutrients are supplied with organic fertilizers. Like inorganic fertilizers, organic fertilizers are also more profitable if added with other sources of nutrients. In general, growth and yield of coriander is doing better when nutrient is applied in an integrated manner .

Table.1. Plant heightat various growth stages of coriander with regard to various treatments of organic manures and fertilizer levels.

	Plant height(cm) at 30 DAS			Plant height(cm) at 60 DAS			Plant height(cm) at 90 DAS		
ORGANIC MANURES	**100 % RDF**	**50 % RDF**	**MEAN**	**100% RDF**	**50% RDF**	**MEAN**	**100% RDF**	**50% RDF**	**MEAN**
VC 5 t/ ha	15.98	13.12	14.55	72.23	69.72	70.97	95.69	90.64	93.17
VC 2.5 t/ ha	13.81	12.14	12.97	70.13	68.64	69.38	92.05	87.68	89.87
FYM 20 t/ ha	13.22	11.30	12.26	70.18	67.13	68.66	93.87	88.17	91.02
FYM 10 t/ ha	11.91	10.45	11.18	68.07	64.87	66.47	89.21	85.41	87.31
MEAN	13.73	11.75	12.74	70.15	67.59	68.87	92.71	87.98	90.34
	(OM)	**(RDF)**	**(OM X RDF)**	**(OM)**	**(RDF)**	**(OM X RDF)**	**(OM)**	**(RDF)**	**(OM XRDF)**
SEm±	0.60	0.42	0.85	0.65	0.46	0.92	0.21	0.15	0.29
CD @ 5%	1.82	1.29	-	1.97	1.39	4.13	0.63	0.44	1.31

FYM- Farmyard manure, VC- Vermicompost , OM- organic manures, RDF- recommended dose of fertilizers, DAS- Days after sowing.

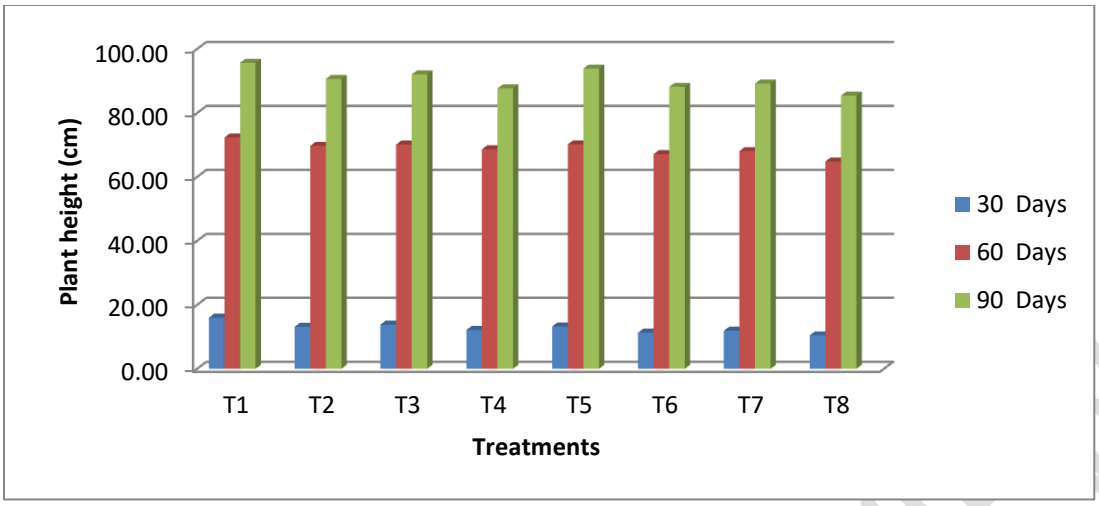

Fig 1. Graph representing variation in plant height at various growth stages due to various treatment interactions.

Table.2 Number of primary and secondary branches per plant of corianderwith regard to various treatments of organic manures and fertilizer levels.

ORGANIC MANURES	Primary branches per plant			Secondary branches per plant		
	100 % RDF	50 % RDF	MEAN	100% RDF	50% RDF	MEAN
VC 5 t/ ha	9.67	8.47	9.07	23.60	20.13	21.86
VC 2.5 t/ ha	8.73	8.20	8.47	21.40	17.43	19.42
FYM 20 t/ ha	8.93	8.27	8.60	20.30	18.67	19.48
FYM 10 t/ ha	8.33	7.87	8.10	19.53	16.13	17.83
MEAN	8.92	8.20	8.56	21.21	18.09	19.65
	(OM)	(RDF)	(OM XRDF)	(OM)	(RDF)	(OM X RDF)
SEm±	0.06	0.04	0.09	0.25	0.18	0.36
CD @ 5%	0.18	0.13	0.38	0.76	0.54	1.6

FYM- Farmyard manure, VC- Vermicompost , OM- organic manures, RDF- recommended dose of fertilizers.

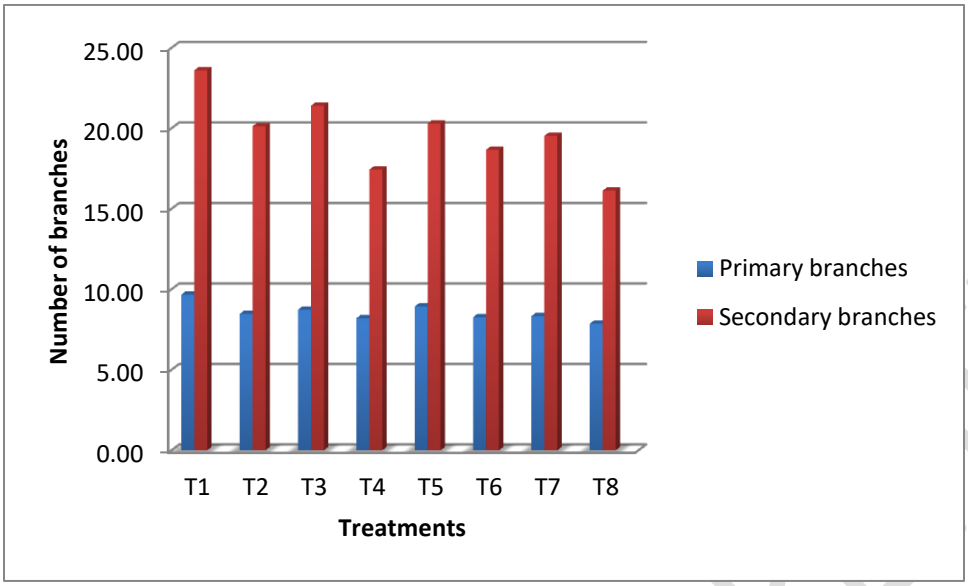

Fig 2.Graph representing variation in of primary and secondary branches per plant due to various treatment interactions.

Table.3. Days taken to first and 50 % flowering in coriander with regard to various treatments of organic manures and fertilizer levels.

ORGANIC MANURES	Days to first flowering			Days to 50 % flowering		
	100 % RDF	50 % RDF	MEAN	100% RDF	50% RDF	MEAN
VC 5 t/ ha	54.33	51.33	52.83	63.67	59.33	61.50
VC 2.5 t/ ha	53.33	50.67	52.00	61.33	58.33	59.83
FYM 20 t/ ha	52.33	50.33	51.33	59.67	57.67	58.67
FYM 10 t/ ha	51.67	47.67	49.67	59.33	55.67	57.50
MEAN	52.92	50.08	51.45	61.00	57.75	59.38
	(OM)	(RDF)	(OM X RDF)	(OM)	(RDF)	(OM X RDF)

SEm±	0.23	0.16	0.32	0.25	0.18	0.36
CD @ 5%	0.69	0.49	1.45	0.76	0.54	1.6

FYM- Farmyard manure, VC- Vermicompost , OM- organic manures, RDF- recommended dose of fertilizers, DAS- Days after sowing.

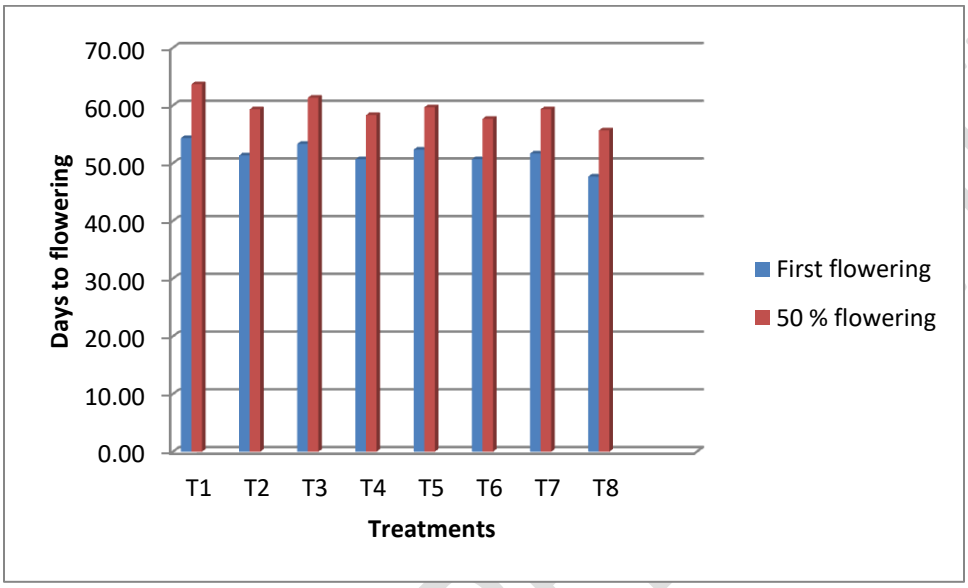

Fig: 3.Graph representing days taken to first and 50 % flowering in coriander due various treatment interactions.

Table.4. Number of umbels per plant, number of umbellets per umbel, seed per umbel, number of seed per umbel and weight of seed per umbelwith regard to various treatments of organic manures and fertilizer levels.

ORGANIC MANURES	NUMBER OF UMBELS PER PLANT			NUMBER OF UMBELLETS PER UMBEL			SEEDS PER UMBEL			WEIGHT OF SEED PER UMBEL (G)		
	100% RDF	50% RDF	Mean	100% RDF	50% RDF	Mean	100% RDF	50% RDF	Mean	100% RDF	50% RDF	Mean

VC 5 t/ ha	34.13	30.53	32.33	7.11	6.54	6.82	34.13	30.90	32.52	0.48	0.38	0.43
VC 2.5 t/ ha	32.07	29.77	30.92	6.81	6.20	6.51	31.97	27.73	29.85	0.42	0.32	0.38
FYM 20 t/ ha	32.67	30.73	31.70	6.99	6.29	6.64	33.07	29.07	31.07	0.47	0.34	0.41
FYM 10 t/ ha	32.10	29.03	30.57	6.78	5.97	6.37	31.43	28.33	29.88	0.42	0.33	0.37
MEAN	32.74	30.02	31.38	6.92	6.25	6.59	32.65	29.01	30.83	0.45	0.34	0.40
	(OM)	**(RDF)**	**(OM) x (RDF)**	**(OM)**	**(RDF)**	**(OM) x (RDF)**	**(OM)**	**(RDF)**	**(OM) x (RDF)**	**(OM)**	**(RDF)**	**(OM) x (RDF)**
SEm±	0.19	0.13	0.27	NS	0.20	NS	0.35	0.25	0.49	0.07	0.05	NS
CD @ 5%	0.58	0.41	1.21	-	0.62	-	1.05	0.75	2.21	0.03	0.02	-

FYM- Farmyard manure, VC- Vermicompost , OM- organic manures, RDF- recommended dose of fertilizers, DAS- Days after sowing.

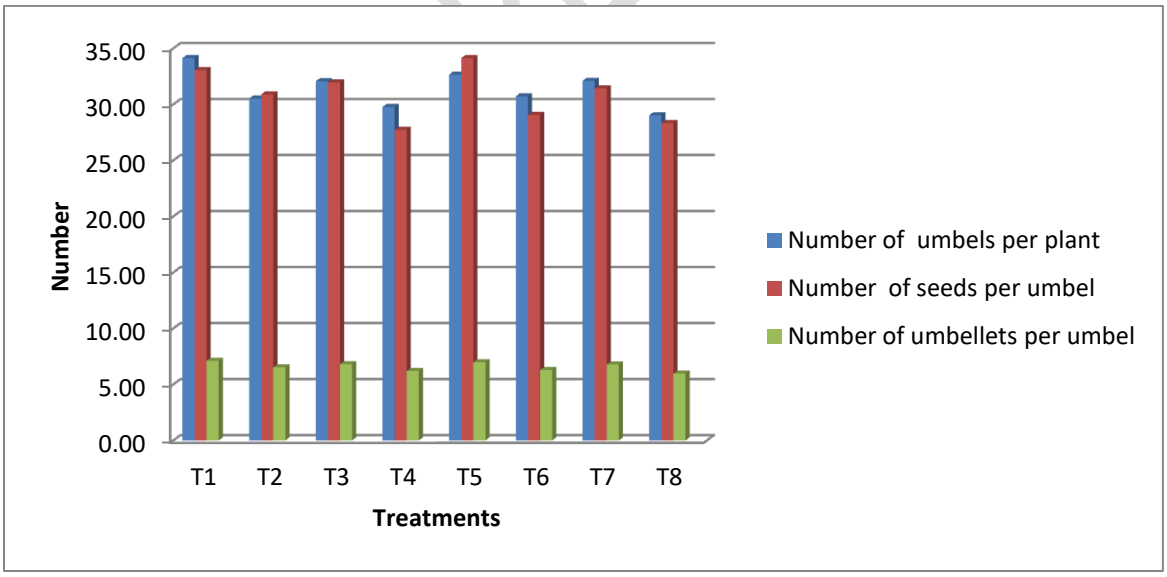

Fig 4. Graph representing variation in number of umbels per plant number of seed per umbel and number of umbellets per umbel due to various treatment interactions.

Table.5. Number of seeds per plant, seed yield per plant (g), seed yield per plot (kg) and seed yield per hectare (q) with regard to various treatments of organic manures and fertilizer levels.

ORGANIC MANURES	NUMBER OF SEEDS PER PLANT			SEED YIELD PER PLANT (G)			SEED YIELD PER PLOT (KG)			SEED YIELD PER HECTARE (Q)		
	100% RDF	50% RDF	Mean	100% RDF	50% RDF	Mean	100% RDF	50% RDF	Mean	100% RDF	50% RDF	Mean
VC 5 t/ ha	598.34	502.54	550.44	6.72	4.34	5.53	1.98	1.67	1.82	18.53	15.61	17.07
VC 2.5 t/ ha	542.92	440.51	491.72	5.23	3.88	4.56	1.75	1.47	1.61	16.43	13.77	15.10
FYM 20 t/ ha	591.37	475.65	533.51	5.78	4.50	5.14	1.90	1.59	1.74	17.81	14.89	16.35
FYM 10 t/ ha	536.49	440.59	488.54	4.89	3.62	4.25	1.72	1.27	1.49	16.14	11.90	14.02
MEAN	567.28	464.82	516.05	6.01	4.25	5.13	1.87	1.53	1.70	17.53	14.30	15.91
	(OM)	**(RDF)**	**(OM) x (RDF)**	**(OM)**	**(RDF)**	**(OM) x (RDF)**	**(OM)**	**(RDF)**	**(OM) x (RDF)**	**(OM)**	**(RDF)**	**(OM) x (RDF)**
SEm±	2.2	1.6	3.1	0.11	0.075	0.15	0.02	0.01	0.03	0.17	0.12	0.25
CD @ 5%	6.71	4.74	14.1	0.32	0.29	0.68	0.05	0.04	0.11	0.53	0.38	1.12

FYM- Farmyard manure, VC- Vermicompost , OM- organic manures, RDF- recommended dose of fertilizers.

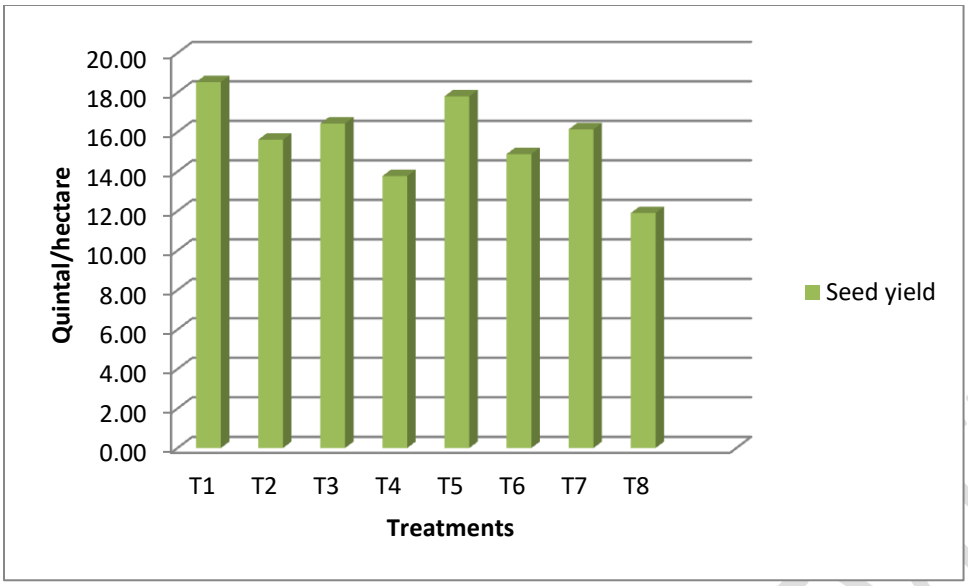

Fig 5. Graph representing variation in seed yield due to various treatment interactions.

ECONOMICS OF VARIOUS TREATMENTS.

The economics regarding the cultivation of the crop is calculated separately for different treatment on hectare basis. The fixed cost of cultivation of crops, fertilizers used in different treatments, cost of seeds etc. were calculated separately to determine the economics of cultivation. The revenue generated from seed yield was also calculated to determine the gross income under organic and fertilizer combinations.

Cost of cultivation (Rs./ha):

The cost of cultivation was directly associated with various inputs *viz*. cost of chemical fertilizers, FYM and vermicompost. The highest cost of cultivation (Rs 57650.6 ha.) was calculated under vermicompost 5 t/ha+ 100 % RDF followed by vermicompost 2.5 t/ha + 50 % RDF (Rs 56825.3 /ha.). While the minimum cost of cultivation (Rs 43125.3/ha.) was recorded by the use of FYM 10 t/ha + 50 % RDF. The high cost of cultivation is due to higher price of vermicompost compaired to FYM.

Gross income (Rs./ha):

The maximum gross income (Rs 129710.00/ha.) was calculated in the treatment vermicompost 5 t/ha+ 100 % RDF with followed byFYM 20 t/ha + 100 % RDF (Rs 124670.00/ha.). While the minimum (Rs 89810.00 /ha.) was found in the treatment FYM 10 t/ha+ 50 %RDF).

Net profit (Rs. /ha):

The maximum net profit (Rs 79419.4 /ha.) was obtained in FYM 20 t/ha+ 100 % RDF) which is the best as compared to other treatments followed by vermicompost 5 t/ ha+ 100 % RDF) (Rs 72059.4/ha), however the minimum net income (Rs 46684.7/ha) was obtained in treatment FYM 10 t/ ha+ 50 % RDF.

Cost: Benefit ratio:

The maximum cost: benefit ratio (1: 2.76) was noted under the treatmentFYM 20 t/ha + 100 % RDF . However, the minimum cost: benefit ratio (1: 1.92) was recorded from vermicompost 5 t/ha +50 % RDF).The reason is due to high cost of vermicompost raised the cost of cultivation resulting reduce in net profit and cost benefit ratio compaired to FYM. Fikadu *et al*., (2019) found that the use of RDF (100%) through fertilizers and combinations of different organic and inorganic sources produces the maximum grain yield (1024 kg/ha), net return (Rs. 59556 /ha) and benefit cost ratio (3.66) in coriander production. Jhankar *et al*., (2017) observed, the maximum net profit (Rs. 107689/ha) and benefit: cost (2.09) in the treatment of inorganic fertilizer (100% of RDF), bio-fertilizers; azotobacter, azospirillum and PSB (2.5 kg/ha and farmyard manure (5 t/ ha). Similarly, it's also reported that 60 kg N ha^{-1} (half dose of nitrogen as basal and remaining half dose at 30 days after sowing) and 60 kg P2O5 ha^{-1} (full doses of phosphorus as basal) is optimum for higher production & net returns from coriander (Javiya *et al.*, 2017).

Therefore, integrated nutrient application is very important in improving the physicochemical and biological conditions of the soils and finally helped in increasing the net profit by maximizing benefit cost ratio (Tripathi *et al.*, 2013; Jhankar *et al*., 2017; Pooja *et al.*, 2017).

Table .6. Economics of crop in relation to different treatments.

CONCLUSION.

The study shows that both the nutrient sources i.e. organic manures and inorganic fertilizers responded well in terms of yield and yield parameters. The interaction of both the nutrient sources showed significant effect on yield and economics. It is concluded that the application of vermicompost 5 t/ha+ 100 % RDF (50:30:60 kg NPK/ ha) recorded the maximum seed yield of coriander variety JD-1 along with gross income followed by FYM 20 t/ha + 100% RDF. However highest net profit and cost benefit ratio 1:2.76 was observed in FYM 20 t/ha + 100%

Symbol	Treatments	Yield (q/ha.)	Cost of cultivatin (Rs. /ha.)	Gross income (Rs. /ha.)	Net income (Rs./ha.)	Cost : Benefit Ratio
T_1	Vermicompost 5 t/ ha + 100 % RDF	18.53	57650.6	129710	72059.4	1:2.25
T_2	Vermicompost 5 t/ ha + 50 % RDF	15.61	56825.3	109270	52444.7	1:1.92
T_3	Vermicompost 2.5 t/ ha +100 % RDF	16.43	50150.6	115010	64859.4	1:2.29
T_4	Vermicompost 2.5 t/ ha +50 % RDF	13.77	49325.3	96390	47064.7	1:1.95
T_5	FYM 20 t/ ha + 100 % RDF	17.81	45250.6	124670	79419.4	1:2.76
T_6	FYM 20 t/ ha + 50 % RDF	14.92	44425.3	104440	60014.7	1:2.35
T_7	FYM 10 t/ ha + 100 % RDF	16.14	43950.6	112980	69029.4	1:2.57
T_8	FYM 10 t/ ha + 50 % RDF	12.83	43125.3	89810	46684.7	1:2.08

RDF. Hence present findings have practical utility in successful cultivation of coriander for Kymore pleatue and Satpura hills of Madhya Pradesh.

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