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REVIEW ARTICLE

EFFECT OF FERTILIZER TYPES ON THE BIOCHEMICAL COMPOUNDS OF CORIANDER (*CORIANDRUM SATIVUM* L.)

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ABSTRACT

Field experiment was carried out at the farmer's field at village Raghogarh, Dist. Guna of Madhya Pradesh to evaluate the effect of vermicompost, biofertilizers and inorganic fertilizers on the biochemical compounds (chlorophyll, carbohydrate and protein) of Coriander (*Coriandrum sativum* L.). Coriander was grown with 8 different combinations of fertilizers using vermicompost, biofertilizers (*Azotobacter* and *Phosphate Solubilizing Bacteria sp. Pseudomonas strata*) and chemical fertilizers (NPK) including one control treatment. The results indicated that the chlorophyll, carbohydrate and protein content of coriander were significantly higher in T_7 treatment compared to other treatments and control at different growth stages. Thus it can be concluded that combined use of different fertilizers is the best option to coriander for better quality crop production.

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INTRODUCTION

Spices are important group of agricultural commodities being used by many civilizations all over the world to aid flavor, taste and nutritional values in the food. They are also used as the flavoring agents in beverages and pharmaceuticals and also as ingredients in perfumes and cosmetics. Herbs and spices have a traditional history of use with strong role in cultural heritage, and in the appreciation of food and its links to health (Tapsell *et al*., 2006, Christine *et al*., 2008). The usage of spices by consumers is increasing worldwide because they are completely natural, rather than artificial additives for flavoring the food. Spice farming is of great importance because spices are one of the major commercial crops of India. Coriander (*Coriandrum sativum* L., 2n = 22), 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, has been cultivated since human antiquity (Small, 1997, Bhuiyan *et al*., 2009, Khan *et al*., 2014) and it is a culinary and medicinal plant. It is grown widely all over the world for seed, as a spice, or for essential oil production.

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India is the world's largest coriander producer (Coskuner and Karababa, 2007). The herb consists of Iron, Magnesium, Vitamins A, B, and C. The most important constituents are the essential oil and the fatty oil. The essential oil content of the plant varies between 0.03 and 2.6%, and the content of fatty oil varies between 9.9 and 27.7 % (Nadeem *et al*., 2013, Ramadan and Morsel, 2002). The seeds are expectorant, stimulant, stomachic, aromatic, carminative, used as a poultice to treat rheumatic pains (Figueiredo *et al*., 2004), as a cholesterol - lowering agent, a digestive stimulant and an anti-hypertensive agent also (Snigdha and Monika, 2013). The seeds are also used as a flavoring agent in different foods namely pastries, cookies, buns, cakes and breads (Akgul, 1993, Figueiredo *et al*., 2004, Bhuiyan *et al*., 2009). In India, soil fertility is diminishing gradually due to soil erosions, water logging, loss of nutrients, accumulation of toxic elements and unbalanced nutrient compensation. Organic manure like vermicompost and biofertilizers along with chemical fertilizers are the best sources to meet the required nutrients of crop. The Chlorophyll in green leaves forms the basis of all life on earth. Chlorophyll pigment occupies a unique role in the physiology, productivity and economy of green plants. Quantity of chlorophyll per unit area is an indicator of photosynthetic capacity of a plant. Carbohydrates are the compounds which provide energy to living cells and Proteins are essential parts of organism and

particulate in every process within cells at every aspect of plant growth and development. Because of the importance and utility of the *Coriandrum sativum* L., improving the crop quality using organics and biofertilizers along with reduce dose of chemical fertilizers is desirable. Therefore, the present study was undertaken to study the effect of fertilizer types on the biochemical compounds (chlorophyll, carbohydrate and protein) of Coriander (*Coriandrum sativum* L.).

Vermicompost + Chemical Fertilizers [5t vermicompost ha^{-1} + 50% NPK ha^{-1} (RDF)], T_6 - Chemical Fertilizers + Biofertilizers [50% NPK (RDF as 30:15:15 kg per ha^{-1}) + 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).

Table 1. Effect of Fertilizer Types on the Biochemical compounds of Coriander (*Coriandrum sativum* L.)

Plot	Treatments		Chlorophyll Content (mg/g)		Carbohydrate Content (mg/g)		Protein Content (mg/g)	
			45 DAS (Vegetative stage)	105 DAS (Harvest stage)	45 DAS (Vegetative stage)	105 DAS (Harvest stage)	45 DAS (Vegetative stage)	105DAS (Harvest stage)
T_1	BF		0.98	0.56	8.91	8.94	6.81	6.83
T_2	VC		1.01	0.69	9.19	9.64	7.32	7.86
T_3	CF		1.03	0.71	6.81	6.97	9.31	9.41
T_4	BF+VC		1.20	0.86	9.4	9.72	10.32	10.48
T_5	VC+CF		1.24	0.92	7.48	7.78	6.39	8.38
T_6	CF+BF		1.15	0.73	6.94	7.61	9.8	9.94
T_7	BF+VC+CF		1.32	1.02	9.58	9.98	10.92	10.96
T_8	NT		0.40	0.10	5.91	6.12	3.12	4.48
SA	Mean		1.0412	0.6988	8.0275	8.345	7.9988	8.5425
SA	Variance		0.081	0.08	1.982	2.042	6.736	4.605
SA	SD		0.2854	0.2821	1.4078	1.4291	2.5953	2.1458
SA	SE_m		0.1009	0.0997	0.4977	0.50525	0.9176	0.7587
SA	95% confidence	Lower	0.8026	0.4629	6.8506	7.1503	5.829	6.7485
	Interval of the difference	Upper	1.2799	0.9346	9.2044	9.5397	10.169	10.337

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 solubilising bacteria.

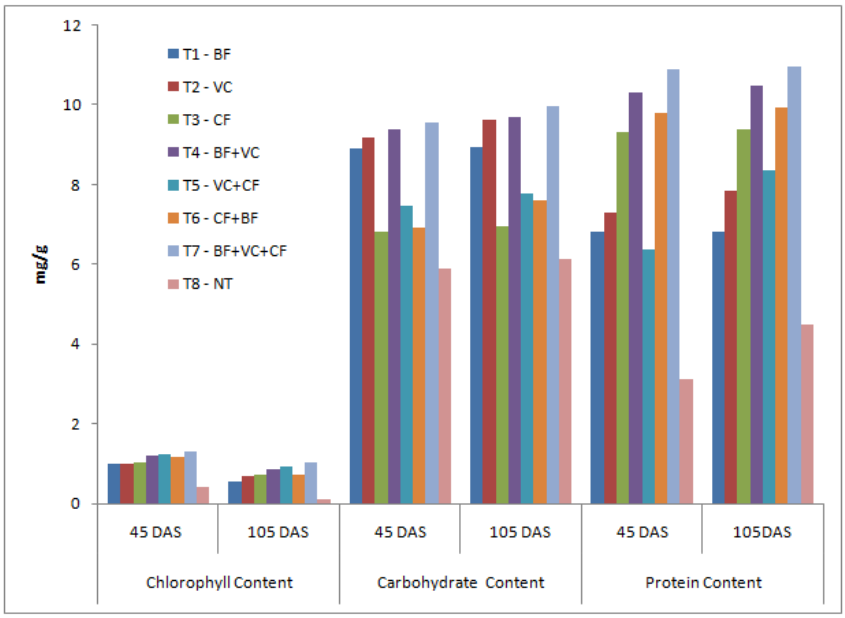

Fig. 1. Effect of Fertilizer Types on the Biochemical compounds of Coriander (*Coriandrum sativum* L.)

MATERIAL 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 vermicompost, biofertilizers (*Azotobacter* and *Phosphate Solubilizing Bacteria*) and chemical fertilizers (NPK) 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 -

Biochemical analysis of plant samples was done by twice in the crop season, at vegetative stage and at harvest stage. In present investigation chlorophyll content (mg/g) was estimated by Arnon method (1949) by using the formula:

Total chlorophyll (mg/g) = 20.2 (A645) + 8.02 (A663) *V/1000*W

The amount of carbohydrate content (mg/g) in the vegetative parts/seed sample was calculated by the Anthrone method described by Black (1951) by using the formula:

Amount of carbohydrate present in 100 mg of the sample

$$= \left(\frac{\text{mg of glucose}}{\text{vol.of the test sample}}\right) \times 100$$

Total protein content in plant was estimated by Lowry's method (Lowry *et al*., 1951) by UV spectrometer.

RESULTS AND DISCUSSION

A significant increase in chlorophyll content (data presented in the Table) of the treatment T_7 (BF @ 250g/ha + VC @ 5t/ha + 50% NPK RDF as 30:15:15 kg/ha) was recorded (1.32 mg/g at 45DAS, 1.02 mg/g at harvest in seed) and found maximum when compared to control treatment. This was followed by the treatment T_5 [VC @ 5t/ha + 50% NPK/ha (RDF). Thus the application of biofertilizers and vermicompost along with chemical fertilizers highly influenced the chlorophyll content of the *Coriandrum sativum*, which in turn reflects the growth. The application of biofertilizers in combination with other fertilizers greatly influenced the chlorophyll a and b density in sweet basil (*Ocimum basilicum* L.) Larimi *et al*. (2014). The results are similar to the findings of Gabr *et al*. (2007) in pea (*Pisam sativum* L.), Hellal *et al*. (2011) in *Anethum graveolens* L. Data presented in the table reveals that total carbohydrate content in Coriander was found maximum (9.58 mg/g at 45 DAS, 9.98 mg/g at harvest in seed) in treatment T_7 (BF @ 250g/ha + VC @ 5t/ha + 50% NPK RDF as 30:15:15 kg/ha) due to balanced availability of nutrients through different fertilizers with integrated manner. This was followed by the application of BF @ 250g/ha along with 5t vermicompost/ha (T_4). Same observations have been reported by El-Quesni *et al.* (2013) in *Jatropha curcas* L., Ahmed *et al*. (2015) in Potato (*Solanum tuberosum* L.). Protein content in Coriander was significantly influenced by different fertilizer types. It was found maximum (10.92 mg/g at 45 DAS, 10.96 mg/g at harvest in seed) in treatment T_7 (BF @ 250g/ha + VC @ 5t/ha in combination with 50% NPK RDF as 30:15:15 kg/ha) due to higher nitrogen content in seed influenced by increased nitrogen availability through biofertilizers (*PSB* + *Azotobacter*) and vermicompost along with NPK by chemical fertilizers, followed by treatment T_4 (BF @ 250g/ha + 5t vermicompost/ha). These findings were also supported by Keshavarzi and Nik (2011) in *Artemisia annua* L., Zarei *et al*. (2012) in soybean (*Glycine max* L.) and Deshmukh and Jain in Lentil (2014).

Conclusion

From the above results it may be concluded that treatment T_7 resulted in positive increase in chlorophyll, carbohydrate and protein content. The highest values were recorded when crop was treated with BF @ 250g/ha + VC @ 5t/ha in combination with 50% NPK RDF as 30:15:15 kg/ha. There is a great potential for increasing export of Indian spices in the form of value added products. To realize this potential there is need to enhance the quality as per international standard through Integrated Nutrient Management with different types of fertilizers.

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