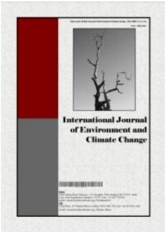

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Impact of Different Fertilizer Sources on Nutrient Uptake in Coriander for Kymore Platueau and Satpura Hills of Madhya Pradesh

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Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

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ABSTRACT

Coriander is an important spice crop grown through out the world. As organic manures tend to reduce the cost of cultivation and supplement the crop with essential nutrients for growth and development of the plant hence the present study the effect of different fertilizers and their doses on nutrient uptake in coriander variety JD-1 was conducted at Horticulture complex, Department of Horticulture, JNKVV, Jabalpur (M.P.) in the year 2011-2012. The experiment consisted of 12 treatments. Viz fertility levels 100% RDF (Recommended dose of fertilizers) (N50P30K60 kg ha-^{1}) and 50% RDF (N25P15K30 kg ha-^{1}) in combinations with organic manures Viz FYM (Farm yard manure) 20 tonnes/ha-^{1} and 10 tonnes/ha-^{1}, Poultry manure 5 tonnes/ha-^{1} and 2.5 tonnes/ha-^{1}, Vermicompost 5 tonnes/ha-^{1} and 2.5 tonnes/ha-^{1}. Among the organic manures, the maximum nitrogen uptake (47.47 kg ha^{-1}) was observed in poultry manure 5 t ha $^{-1}$,while the minimum nitrogen uptake (34.08 kg ha^{-1}) in FYM 10 t ha $^{-1}$.The maximum phosphorus uptake (31.63 kg ha^{-1}) was found in poultry manure 5 t ha $^{-1}$, while it was minimum (26.20 kg ha^{-1}) in vermicompost 2.5 t ha $^{-1}$. Potassium uptake was maximum (16.11kg ha^{-1}) in vermicompost 5 t ha $^{-1}$, while it was minimum (15. 19 kg ha^{-1}) in FYM 10 t ha $^{-1}$. With regard to fertilizer levels maximum nitrogen (43.91 kg ha^{-1}), phosphorus (30.92 kg ha^{-1}), and potash (15.92 kg ha^{-1}) uptake was found with 100% RDF. While it was minimum (37.16 kg ha^{-1}, 26.10 kg ha^{-1} and 15.13 kg ha^{-1} respectively) with 50% RDF. In case of interaction effect, the maximum nitrogen (51.96 kg ha^{-1}) and phosphorous (34.90 kg ha^{-1}) uptake was in treatment T5 (Poultry manure 5 t ha $^{-1}$ + 100% RDF) while maximum

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potassium uptake (16.48 kg ha^{-1}) was found in T9 (Vermicompost 5 t ha^{-1}+ 100% RDF). However, the lowest (14.76 kg ha^{-1}) potassium uptake was found with treatment T4 (FYM 10 t ha^{-1} + 50% RDF). Hence it is concluded that maxium nutrient uptake is noticed in treatment consisting of Poultry manure 5 t ha^{-1} along with 100% RDF as compared to other treatments in coriander JD-1.

Keywords: Nutrient uptake; coriander; organic manures; fertilizers.

1. INTRODUCTION

Coriandrum sativum L. is an annual herb commonly known as cilantro or coriander from the family Apiaceae. It is likely one of the first species used by humanity, being known since 5000 years before Christ. It is native to the western Mediterranean. Coriander seeds contains high amount of minerals which are very important to regulate body's metabolism and widely used in folk medicine in addition to its use as a seasoning in food preparation [1,2]. It is an essential component of ayurvedic medicine used for treatment of digestion and gastric ailments. Essential oils of its seed extracts possess numerous valuable constituents which could be exploited for the preparation of medicinal combatants against several acute and chronic diseases [1,3]. It is very low in saturated fat however, contains good amount of linoleic acid which is a good source of α-tocopherol and vitamin K.

Production of coriander continues to be constrained by a number of factors that can reduce yield quantity and quality like other crops [4]. Among those factors, fertilizer management has considerable practical importance. If the amount of any nutrient is limiting, there is a potential for yield loss in production [5,6]. By several means nutrients are exported from the fields where crops are grown and nutrient supply in the soil can become depleted.

Crop nutrient management is important phenomena in agricultural crop to provide ample nutrient demand for crop growth and development throughout the growing period. However, continuous application of suboptimal doses of fertilizers may leads to depletion of nutrient reserves in the soil. Cilantro requires good soil fertility; otherwise, the production and productivity is reduced. In addition, the crop responded to fertilizer limitation; the leaves become pale yellow. However, soil that is too rich can also cause a diluted flavor [7]. To meet the crop nutrient requirements, it's essential to apply nutrients from different sources in modern cropping system [8]. Nutrient application from all sources such as organic, inorganic and biofertilizers are very important for increasing crop production. Integrated soil nutrient management is critical to increase productivity and efficient use of available nutrients minimize nutrient losses to the environment. Thus, supplementing is required through application of external fertilizers. Furthermore, the farmer's economic returns have increased substantially due to fertilizer use in crop production [5].

The main objective of this review was to overview the role of nutrient management for coriander (*Coriandrum sativum* L.) crop production with putting direction on how to increase production and productivity by considering factors such as soil, climate and varieties particularly in kymore pleatue and satpura hills.

2. MATERIALS AND METHODS

2.1 Description of the Study Area

The field experiment was conducted at Horticulture complex Department of Horticulture, Jawaharlal Nehru Krishi Vishwa vidyalaya , Jabalpur, Madhya Pradesh during the winter seasons (Rabi) of 2012-2013 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 situated in "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 maximum and minimum temperature ranges between 46.6^0C and 21^0C. The mean relative humidity reaches up to 78% during winter (November- February) with occasional frost. The experimental soil was medium black with good drainage, uniform texture with medium fertility status having 6.8 (g ha^{-1}) organic carbon, $KMn0_4$ extractable N- 253 kg ha-ˡ, Olsen's P_20_5-10.5 kg ha and 1 N ammonium acetate extractable K_20-336 kg ha-ˡ with 6.93 pH.

2.2 Treatment and Experimental Design

The Design of experiment was Randomized complete block design (RCBD) with three replications. The experiment consisted of 12 treatment : T1 (FYM 20 t/ha + 100% RDF),T2 (FYM 20 t/ha + 50% RDF) , T3 (FYM 10 t/ha + 100% RDF), T4 (FYM 10 t/ha + 50% RDF), T5 (Poultry manure 5 t/ha + 100% RDF) , T6 (Poultry manure 5 t/ha + 50% RDF), T7 (Poultry manure 2.5 t/h + 100% RDF), T8 (Poultrymanure 2.5 t/ha + 50% RDF), T9 (Vermicompost 5 t/ha + 100% RDF), T10 (Vermicompost 5 t/ha + 50% RDF), T11(Vermicompost 2.5 t/ha +100% RDF), T12 (Vermicompost 2.5 t/ha + 50% RDF. Layout of the experiment was done as per plan of the investigation and treatments as given. The well decomposed FYM, Poultry manure and Vermicompost was applied in required plots before sowing of seeds. It was mixed well in each plot by light ploughing. Chemical fertilizers were applied manually at the time of sowing in furrows, half amount of N with full amount of P and K were given per plot as basal dose. Nitrogen was supplied through urea, phosphorus through SSP and potash through Muriate of potash @ 50:30:60 in plots of RDF 100% and 25:15:30 in plots of RDF 50% , 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.

2.3 Soil Sampling and Analyses

Soil samples were collected randomly from plough layer depth (0-15 cm) with the help of soil sampling tube before sowing and after harvesting of crops from each plot to know the initial and finally fertility status of soil. The samples were mixed thoroughly and air dried. The soil samples so prepared were subjected to chemical analysis for evaluating soil fertility status following standard procedures. Determination of available nitrogen was done by alkaline permanganate method suggested by Subbiah and Asija [9]. The estimation of available P was done by using Olsen's extract (0.5 N sodium bicarbonates solution of pH 8.5) as referenced by Olsen et al. [10]. It was determined as stannous chloride reduced blue colour. The extraction procedure adopted was as described by Black [11] and developing the colour in the extract [12] using "UV visible Spectrophotometer". The available potassium was determined by using normal neutral ammonium acetate Flame photometer [11]. Electrical conductivity was also determined by electrical conductivity meter in 1:2 soil water suspensions at 25^{o}C and it is expressed as dS /m (deciSeimens per meter). The soil reaction was determined from soil sample paste 1:2 (soil: water ratio) using systronics pH meter model-326. Organic carbon was determined by Walkley and Black [13] wet digestion method. Organic carbon content in soil is expressed in percent of soil [14].

2.4 Plant Sampling and Analyses

For analyzing nutrient content in plant, the plant samples for each plot were collected randomly at harvest stage. These samples were oven dried at 60˚C temperature for about 48 hours. Grinding of oven dried plant and the wet digestion (2:1 nitric acid and perchloric acid) of plant samples were carried out. Nitrogen was determined by KEL (Kjeldahl method) plus (Classic Model), for which 0.5 g of dry plant sample was taken and digested in 200 ml tube with concentrated H_2SO_4 (20 ml) in presence of triple salt mixture consisting of potassium sulphate, copper sulphate. The digested material was transferred to distillation unit and was distilled with 40 ml of 40% sodium hydroxide solution. The distilled ammonia was collected in 4% boric acid solution. After complete distillation, the distillate was titrated against 0.01 N standard sulphuricacid. The equivalent amount of nitrogen was calculated and results were expressed as content of nitrogen in per cent. For Determination of phosphorous and potassium one gram of oven dried plant sample was digested in diacid mixture consisting of concentrated nitric acid and perchloric acid in the ratio of 2.5: 1 on hot plate till clear solution was obtained. The digested material was filtered through Whatman filter paper No. 40 and diluted to 100ml mark. Filtrate was used for determination of Phosphorous (P) and Potassium (K).Taking the liquid from the stock solution, P content was estimated by the vanadomolybdo phosphoric acid. Yellow colour method in nitric acid system as described by Jackson [15]. The K content in extract was estimated by flame photometer as described by Black [11].

Table 1. Chemical properties of experimental field at initial stage (0-15 cm depth)

S. No.	Soil component	Analytical value	Method
1	Electrical conductivity (ds m^{-1})	0.13	Solu-bridge method [11]
2	Soil (pH)	6.93	1:2.5 (soil: water) suspension using glass electrode pH meter. [15]
3	Organic carbon (g ha^{-1})	6.8	Walkley and Black's titration method [13]
4	Available nitrogen (kg ha^{-1})	253	Alkaline permagnate method [9]
5	Available phosphorus (kg ha^{-1})	13.5	Olsen's method [15]
6	Available potassium (kg ha^{-1})	336	Neutral normal ammonium acetate using Flamephotometer. [15]

2.5 Calculations

For calculation the amount of nitrogen the equivalent weight of NH_3 is 17g/eq. And, 14 gm of Nitrogen is contained one equivalent weight of NH_3. So, the percentage of nitrogen can be determined using the following formula:

$$\text{Kjeldahl method of nitrogen estimation} = \frac{1.4V \times N}{W}$$

Where,W = Weight of the sample used (in grams),V = Acid used in titration (in ml), N = Normality of standard acid.

For phosphorous calculation after nitric oxidation and ashing, and dissolution in hydrochloric acid, phosphoric acid is determined colorimetrically as the yellow phospho-vanadomolybdate complex. The total phosphorous content expressed in milligrams per liter of phosphoric anhydride, P2O5, is obtained by entering the absorbance of the wine sample on the calibration graph and interpolating the total phosphorus concentration. From the calibration curve, find the concentration of the sample. The total phosphorous content is expressed in milligrams per liter P2O5 to the nearest whole number. The K content in extract was estimated by flame photometer emission intensity data was collected for the standard and sample solutions, plot the calibration curve. A graph between the mean of the K^+ ion signal on Y- axis and the concentration of standard K^+ ion on X – axis is ploted, concentration value of the sample solution is obtained in ppm, extrapolating cross section point of calibration curve and the intensity of the K^+ ion signal towards X – axis , let the concentration of K^+ ion in the sample solution obtained from the graph = P ppm .The actual concentration of K^+ ion in the sample solution would be P X 2 ppm as the sample solution was diluted 2 times, the actual concentration of K^+ ion should be obtained by multiplying the concentration obtained from the graph by 2.

2.5 Data Analyses

The statistical analysis of data recorded in all observations was computed by methods of analysis of variance, Whatever, various ratio (calculated 'F' value) was found significant critical difference (CD) values were computed for making comparison between the treatments:

To test the significance difference among the treatment means. Following formula were used for calculating the critical differences for main plot, sub plot and interaction.

Estimate of CD for comparison of two organic level of means

S.Em. $= \sqrt{\frac{MSE}{rB}}$, SE(d) $= \sqrt{\frac{2MSE}{rB}}$

CD = S.Em. × √2 × 't' at error df

Estimate of CD for comparison of two Fertilizer level of means

S.Em. $= \sqrt{\frac{MSE}{rA}}$, SE(d) $= \sqrt{\frac{2MSE}{rA}}$

CD = S.Em. × √2 × 't' at error df

Estimate of Interaction (A×B)

$$S.Em. = \sqrt{\frac{MSE}{r}}$$

CD = S.Em. × √2 × ‘t’ at error df

The significance difference between mean was determined by using critical difference.

S. Em. ± = √EMSS/replication
S. Ed. ± = √2×EMSS/ replication
C. D. = S. Ed. × t 5% at error d .f.

3. RESULTS AND DISCUSSION

3.1 Soil Properties

The soil properties like Electrical conductivity , Soil (pH), Organic carbon , available nutrients like nitrogen, phosphrous and potassium after the complition of crop cycle were also influenced due to various level of organic manures, fertilizers levels and treatment interaction over the initial status of soil. The changes in soil properties due to different treatments is shown in Table 2.

3.2 Nitrogen Uptake

Nitrogen uptake is effected by different level of organic manures, fertilizers levels and treatment interaction and the variation nitrogen uptake is showen in table 3. Among the organic manures poultry manure @ 5 t ha $^{-1}$ recorded maximum nitrogen uptake (47.47 kg ha^{-1}) followed by poultry manure @ 2.5 t/ ha (42.55 kg ha^{-1}) while, the minimum nitrogen (34.08 kg ha^{-1}) uptake was recorded in FYM 10 t ha $^{-1}$. Low nitrogen uptake in treatments with FYM may be due to low nitrogent percent in FYM because urine, which is wasted, contains one per cent nitrogen and 1.35 per cent potassium. Nitrogen present in urine is mostly in the form of urea which is subjected to volatilization losses. Even during storage, nutrients are lost due to leaching and volatilization. Among the RDF levels, the maximum nitrogen uptake was observed in 100%

Table. 2. Change in soil properties over initial stage as influenced by different treatment combinations

Treatments	Soil (pH),	Electrical conductivity (ds m^{-1})	organic carbon (g ha^{-1})	Available nutrients (kg ha^{-1})		
				N	P	K
T1(FYM 20 t/ha + 100% RDF)	7.02	0.19	4.5	190	8.6	350
T2 (FYM @ 20 t/ha + 50% RDF)	6.94	0.15	5.5	207	12.5	542
T3 (FYM 10 t/ha + 100% RDF)	7.16	0.11	4.1	181	9.1	331
T4 (FYM 10 t/ha + 50% RDF)	7.26	0.17	4.7	193	9.9	282
T5 (Poultry manure 5 t/ha + 100% RDF)	7.02	0.17	5.2	202	10.4	400
T6 (Poultry manure 5 t/ha + 50% RDF)	6.88	0.18	5.8	216	8.9	289
T7 (Poultrymanure 2.5 t/h + 100 % RDF)	6.87	0.10	4.5	190	9.6	249
T8 (Poultrymanure 2.5 t/ha + 50% RDF)	6.92	0.13	4.7	193	9.9	267
T9 (Vermicompost 5 t/ha + 100% RDF)	7.14	0.17	6.2	230	8.9	315
T10 (Vermicompost 5 t/ha + 50% RDF)	6.98	0.17	3.7	169	9.7	235
T11 (Vermicompost 2.5 t/ha +100% RDF)	7.14	0.15	5.9	219	10.1	256
T12 (Vermicompost 2.5 t/ha +50% RDF)	7.02	0.17	7.2	266	18.0	232

RDF. While, the minimum in 50% RDF. Among the interaction effect, the maximum (51.96 kg ha^{-1}) nitrogen uptake by coriander plants was recorded in the treatment combination of T5 (Poultry manure 5 t ha^{-1} + 100% RDF) followed (46.03 kg ha^{-1}) by T9 (Vermicompost 5 t ha^{-1} + 100% RDF). Whereas, the minimum (30.70 kg ha^{-1}) nitrogen uptake was recorded in treatment combinations of T4 (FYM 10 t ha^{-1} + 50% RDF).Quite similar results were illustrated by Channabasavanna [16]; Kumar et al. [17], Usman et al. [18]; Salem and Awad [19] and Tripathi [20,21]. Manure N uptake was notably lower compared to the uptake from inorganic N sources as it is, in most cases, not readily available for immediate crop uptake. Manure N, on the contrary, has N mostly bound within organic fractions that require some kind of degradation so as to release available plant N [22,23]. This observation is similar to that by Ma et al. [24]. who reported a significantly lower manure N uptake efficiency compared to inorganic N uptake efficiency even when grain yield levels were comparable for the two input sources. Under ample soil N availability, crop N accumulation is highly related to crop growth rate and to biomass accumulation. This non-linear relationship between crop N content and crop biomass appears to be a general phenomenon for vegetative crops as it has been reported for many species [25-31]. low N uptake from the any N source could suggest a potential for environmental pollution. Appropriate timing and application rate of manure N sources could optimize crop use efficiency and limit potential threat to the environment. Understanding the processes that govern N fluxes, particularly N uptake and distribution in crops, is of major importance with respect to both environmental concerns and the quality of crop products.

3.3 Phosphorus Uptake

Phosphorus uptake in coriander is markedly influenced by different level of organic manures, fertilizers levels and treatment interaction and the variation phosphorus uptake is showen in table 3. Among the organic manures, poultry manure 5 t ha^{-1} had higher phosphorus uptake (31.63 kg ha^{-1}), followed by FYM 20 t ha^{-1} (28.85 kg ha^{-1}) and Poultry manure 2.5 t ha^{-1}(28.70 kg ha^{-1}). However, the minimum (26.20 kg ha^{-1}) was found in Vermicompost 2.5 t/ha. Among the fertilizer levels the maximum phosphorus uptake (30.92 kg ha^{-1}) was found in 100% RDF, while the minimum in 50 % RDF (26.10 kg ha-^{1}). Among the treatment combinations, treatment T5 (Poultry manure 5 t ha^{-1} + 100% RDF) had higher phosphorus uptake (34.90 kg ha^{-1}) followed by T1 (FYM 20 t ha -1 + 100 % RDF) (31.25 kg ha^{-1}). While the lowest (23.28 kg ha^{-1}) phosphorus uptake was recorded by treatment T12- (Vermicompost 2.5 t ha^{-1}+50%RDF). The present findings corroborated the best results of Channabasavanna [16], Salem and Awad [19] and Tripathi [20,21]. Organic matter increases P availability in four ways. First, organic matter forms complexes with organic phosphate which increases phosphate uptake by plants. Second, organic anions can also displace sorbed phosphate.Third, humus coats aluminum and iron oxides, which reduces P sorption. Finally, organic matter is also a source of phosphorus through mineralization reactions. Nitrogen nutrition plays the most important part in ion balance since it is the mineral taken up in the largest quantity by most plants and it can occur as either an anion (NO3 -) or a cation (NH4 +). Research suggests that greater P uptake that occurs as plants are fertilized with a source of NH4 + may be the result of rhizosphere acidification that occurs with this N source. However, depending on the buffering capacity of the soil, only little change in pH may be observed in some soils. P uptake and P concentration have significant correlation . Uptake of P from soil by plants under optimal growth ranges from 20 to 50 kg ha^{-1} [32,33]. The difference with the amount needed to meet physiological requirements, implies that, in many instances, less P is required for optimal plant growth, relative to the amount of P supplied and taken up by the plant. Foyer and Spencer [34] observed large differences in vacuolar P (non-metabolic pool) content among plants grown with different levels of phosphate supply, whereas cytoplasmic P (metabolic pool) is maintained at a constant level. Thus, much of the P is stored in vacuoles as phytate (the salt form of phytic acid; PA), buffering the P in the cytoplasm [35]. At critically low levels of cellular phosphate, vacuolar P is depleted, to maintain cytoplasmic inorganic P (Pi) homeostasis.This increased P uptake from various combinations of by-products resulted in higher P fertilizer efficiency over SSP alone. This indicates that integrated use of P ratio, compared to SSP alone, could be more effective for better utilization of applied P in coriander.

3.4 Potassium Uptake

Potassium uptake is effected by different level of organic manures, fertilizers levels and treatment interaction and the variation potassium uptake is

Table 3. Nitrogen, phosphorus and potassium up take as influenced by various organic manures , fertilizer levels and interaction effect

Organic manures	Nitrogen uptake.			Phosphorus uptake.			Potassium uptake .		
	100% RDF	**50% RDF**	**Mean**	**100% RDF**	**50% RDF**	**Mean**	**100% RDF**	**50% RDF**	**Mean**
FYM @ 20 t/ ha	40.56	34.85	37.72	31.25	26.44	28.85	16.10	15.07	15.59
FYM @ 10 t/ ha	37.45	30.70	34.08	29.46	25.49	27.48	15.63	14.77	15.20
PM @ 5 t/ ha	51.96	42.97	47.47	34.90	28.35	31.63	15.85	15.13	15.49
PM @ 2.5 t/ ha	45.67	39.44	42.55	30.26	27.14	28.70	15.43	14.99	15.21
VC @ 5 t/ ha	46.03	37.13	41.58	30.54	25.92	28.23	16.48	15.74	16.11
VC @ 2.5 t/ ha	41.73	37.86	39.80	29.12	23.28	26.20	16.04	15.46	15.75
Mean	43.91	37.16	40.53	30.92	26.10	28.51	15.92	15.19	15.56
	(OM)	**(RDF)**	**(OM) X (RDF)**	**(OM)**	**(RDF)**	**(OM) X (RDF)**	**(OM)**	**(RDF)**	**(OM) X (RDF)**
SEm±	0.952	0.550	1.346	1.227	0.708	1.735	0.420	0.243	0.595
CD @ 5%	2.792	1.612	3.949	3.598	2.077	5.086	1.233	0.712	1.744

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

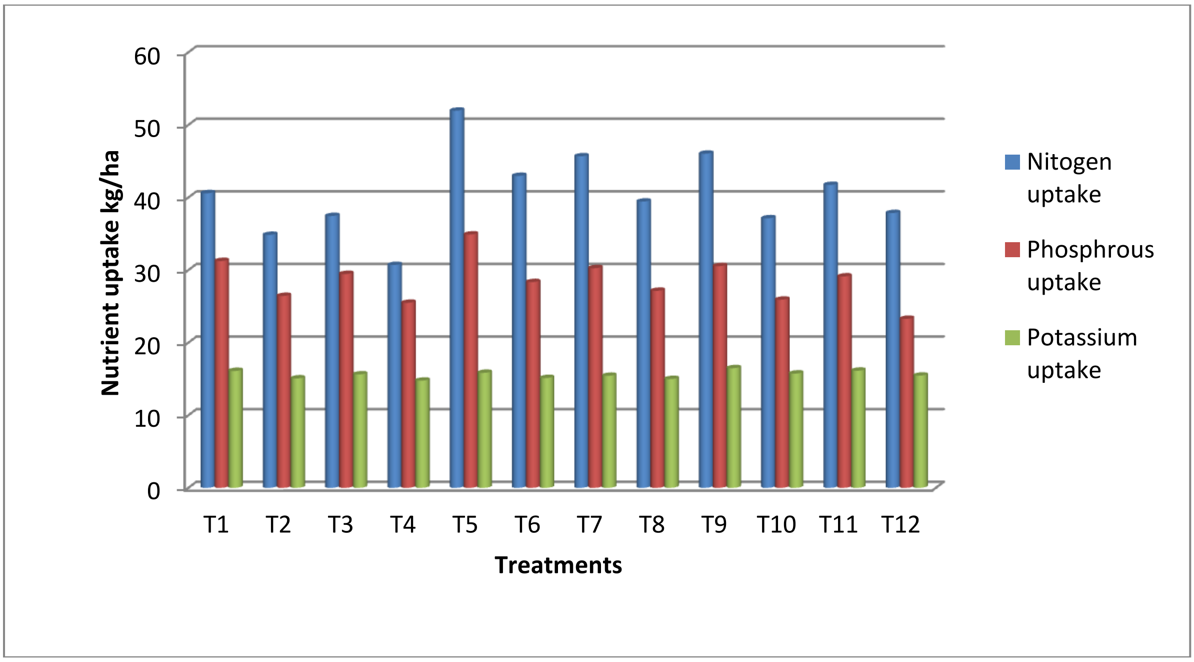

Fig 1. Representing nitrogen, phosphrous and potassium uptake with regard to different treatments

showen in Table 3. Among the organic manures maximum potassium uptake (16.11 kg ha^{-1}) was found under vermicompost 5 t/ ha followed by vermicompost 2.5 t ha $^{-1}$(15.74 kg ha^{-1}), while minimum potassium uptake (15.19 kg ha^{-1}) was found in FYM 20 t ha $^{-1}$. Among the fertilizer levels the maximum potassium uptake (159.22 kg ha^{-1}) was found in 100% RDF, while the minimum (15.193) in 50% RDF. Among the treatment interactions the maximum potassium uptake (16.483 kg ha^{-1}) was found under treatment T9 (Vermicompost 5 t ha $^{-1}$ + 100% RDF) followed by treatment T1(FYM 20 t ha $^{-1}$ + 100% RDF) (16.10 kg ha$^{-1)}$. However, the lowest (14.76 kg ha^{-1}) potassium uptake was found under the treatment T4 (FYM 10 t ha $^{-1}$ + 50% RDF). Channabasavanna [16], Salem and Awad [19] and Tripathi [20,21] observed similar result. Plants with higher yield remove high N, P and K from the soil. Similar findings were elaborated by Sadanandan and Hamza [36] in black pepper. The uptake of K^+ by roots exhibits a biphasic kinetics in response to increasing external concentrations corresponding to high- and low-affinity transport systems, which work at low and high external K^+ concentrations respectively [37-42]. Together, these mechanisms allow plants to maximize their nutrient acquisition abilities while protecting against the accumulation of excess nutrients, which can be toxic to the plant. The factors that affect availability of K in the soil and resulting plant uptake are soil factors, plant factors, and fertilizer and management practices. Availability and uptake of potassium (K) is often complicated by many interacting components, improved fertilizer and management practices, can be used to modify the inherent characteristics of soils and plants involving K uptake. As crop yields increase, total K uptake increases. When adequate K is available, addition of N and/or phosphorus (P) greatly increases K uptake, as yields are increased. Potassium is readily available from all these sources, provided they are located where roots can absorb the K. But the effectiveness of mineral K fertilizer decreased when applied in combination with FYM because FYM was the preferred source of K. Where FYM application increased the CEC of soils, this also improved K utilization but only where K was not extensively leached or fixed.

4. CONCLUSION

A positive relationship was observed between uptake of the major nutrients and yield, probably through better uptake of N, P and K and their utilization in protein synthesis. Hence it can be concluded that the application of fertilizer significantly increased the N, P, K contents and there uptake by crop and the present findings have practical utility in successful cultivation of coriander for Kymore pleatue and Satpura hills of Madhya Pradesh.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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