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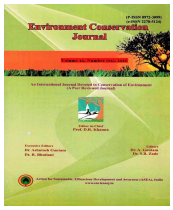

Effect of vermicompost and fertilizer on uptake and efficiency of nutrients in pot culture rice

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ABSTRACT

Rice is the major dominant crop in the asian continent and all over the world. A research was carried out at Dr. Rajendra Prasad Central Agricultural University, Pusa in *kharif, 2018* containing four different levels of vermicompost (0 t/ ha , 1.25 t/ ha, 2.5 t/ ha, 3.7 t/ ha) and three levels (0 %, 100 %, 50 % Recommended Dose of Fertilizer) of fertilizer RDF were combined with each other and analyzed for nutrient uptake and efficiencies in pot cultured rice crop variety *Rajendra Bhagawati.* Study revealed that nutrient uptake in grain (446.03 mg/ pot N, 104.95 mg/ pot P , 112.06 mg/ pot K) and straw (303.81 mg/ pot N , 49.83 mg/ pot P, 578.78 mg/ pot K) and the total nutrient uptake i.e. N (227.67 mg/ pot), P(0.083 mg/ pot), K(690.84 mg/ pot) were superior in the combined application of 3.75 t/ ha vermicompost and 100% RDF over other and showed higher stability in case of apparent nutrient use efficiency in 3.75 t/ ha vermicompost and 50% RDF except potassium for balanced growth of rice crop and declining straight 50% cost off chemical fertilizer substituted with organic sources.

Introduction

Rice is the most important food crop grown in the world with a production of nearly more than 509.8 million tons milled rice and the productivity is about 3100 kg/ha (Rice - statistics & facts-2021) as well as staple food in south East Asian region to mitigate the food crisis created by over population. To increase the crop production heavy application of chemical fertilizers are unfavourable for soil health condition along with decline in soil microbial activities. To maintain the soil fertility, soil health and enhance soil organic matter, combined applications of vermicompost with fertilizers are being recommended. Vermicompost are the ultimate fine particles secreted from casts of earthworms enriched with macro and micro nutrients i.e. N, P, K, Ca, Mg, Fe etc are readily available to plants (Piya *et al.,* 2018) along with enzymes responsible for plant growth stimulation, prevention of plant diseases and enhancement of rice crop yields by about 40% (Kamaleshwaran and Elayaraj, 2021). The combined application of vermicompost and fertilizer in integrated nutrient management helps in improving soil health and fertility status along with increasing the nutrient use efficiency (Manivannan *et al.,* 2020) which reduces the cost of cultivation and also provides a subtract for better growth of microbes in soil which will improve the soil physical, chemical and biological

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properties. Proper binding of soil particles in presence of healthy organic matter content and helps in proper establishment and growth of rice crop, ensuring higher productivity of rice.

Material and Methods

The research was carried out in department of soil science, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar consisting of four levels of vermicompost (0 t/ ha, 1.25 t/ ha, 2.5 t/ ha, 3.7 t/ ha) and three levels (0 %, 100 %, 50 % RDF) of fertilizer mixed and taken in pot where rice crop (*Rajendra Bhagwati*) was grown with twelve treatment replicated thrice using Factorial Completely Randomized Design. The treatment details are as follows:

$V_0 F_{0:}$- No manure + No Fertilizer- Control
$V_0 F_{100:}$- No manure + 100% RDF
$V_0 F_{50:}$- No manure + 50% RDF
$V_{1.25} F_{0:}$- Vermicompost (1.25 t/ ha) + No Fertilizer
$V_{1.25} F_{100:}$- Vermicompost (1.25 t/ ha) +100% RDF
$V_{1.25} F_{50:}$-Vermicompost (1.25 t/ ha) + 50% RDF
$V_{2.50} F_{0:}$-Vermicompost (2.5 t/ ha) + No Fertilizar
$V_{2.50}F_{100:}$-Vermicompost (2.5 t/ ha) + 100%RDF
$V_{2.50}F_{50:}$-Vermicompost (2.5 t/ ha) + 50% RDF
$V_{3.75}F_{0:}$-Vermicompost (3.75t/ ha) + No Fertilizar
$V_{3.75}F_{100:}$-Vermicompost (3.75 t/ ha) + 100%RDF
$V_{3.75}F_{50:}$-Vermicompost (3.75 t/ ha) +50% RDF

No. of treatment	:	12
No. of replication	:	3
Crop	:	Rice
Variety	:	Rajendra Bhagwati
Recommended Dose of Fertilizer	:	N: P_2O_5:K_2O:: 120:60:40 kg/ha
Experimental Design	:	Factorial Completely Randomized Design
Pot capacity	:	10 kg
Factor	:	02
Total number of pots	:	36

A. Uptake of Nutrients (mg/ pot)

Total uptake of N, P and K by rice crop was calculated by multiplying the N, P and K content with dry matter yield. Nutrient content (%) x dry matter (mg/ pot) 100

$$\textbf{Nutrient uptake} = \frac{\textbf{Nutrient content (\%) x dry matter (mg pot}^{-1}\textbf{)}}{\textbf{100}}$$

B. Efficiency of Nutrients (%)

$$\textbf{Apparent-nutrient recovery (\%)} = \frac{\textbf{Uptake treated plot (g /pot)} - \textbf{Uptake in control plot (g /pot)}}{\textbf{Amount of nutrient applied (g /pot)}} \times \textbf{100}$$

C. Statistical analysis:

All the data obtained in the experiment will be analyzed statistically applying Factorial Completely Randomized Design by the method of "Analysis of Variance" as described by Gomez and Gomez (1984). The Significance of the treatment effect was judged with the help of variance ratio test. Critical Difference (C.D.) at 5 percent and 1 percent level of significance worked out to determine the difference between treatment means. All the statistical analysis were done by using OPSTAT (http://14.139.232.166/opstat/default.asp) analysis software.

Results and Discussion

Grain nitrogen uptake (mg/ pot):

The effect of different levels of vermicompost and fertilizer on grain nitrogen uptake is shown in the table-1. The levels of vermicompost i.e. 1.25 t/ ha, 2.5 t/ ha, 3.75 t/ ha recorded significantly higher grain nitrogen uptake over no vermicompost level. The fertilizer levels of 50 and 100 % RDF also gave significantly superior grain nitrogen uptake over no fertilizer level. The interactions among the different levels of vermicompost and fertilizer were found significant. The integrated application of vermicompost (3.75 t/ ha) + 100 % NPK showed the significantly higher amount of grain nitrogen uptake i.e. 446.03 mg/ pot at harvest stage over the control (133.47 mg/ pot).

The increase in grain nitrogen uptake might be due to the mineralization of nutrients by the favorable micro flora and availability of nutrients increased the uptake by the plant thus increased grain nitrogen uptake. The 50 % Recommended dose of nitrogen + 50 % Green manure application increased grain N uptake (Mounika *et al.* 2017) and inorganic fertilizer also enhanced nutrient uptake by plants during the crop growth (Masni and Wasli, 2019).

Grain phosphorus uptake (mg/ pot):

The table-1 showed different levels of vermicompost and fertilizer on grain phosphorus uptake. The three levels of vermicompost i.e. 1.25 t/ ha, 2.5 t/ ha, 3.75 t/ ha gave significantly higher grain phosphorus uptake over no vermicompost level. The fertilizer levels of 50 and 100 % RDF recorded significantly superior grain phosphorus uptake over no fertilizer level. The interactions among the different levels of vermicompost and

fertilizer were found significant. The integrated application of vermicompost (3.75 t/ ha) + 100 % NPK recorded the significantly higher amount of grain phosphorus uptake i.e. 104.95 mg/ pot at harvest stage over the control (24.28 mg/ pot).The increase in grain phosphorus uptake might be due to CO2 produced during mineralization of different organic sources took role in P solubilisation (Sagarika *et al.* 2012) and the comparable effect on nutrient uptake content was given by (Masni and Wasli, 2019).

Grain potassium uptake (mg/ pot):

The influence of different levels of vermicompost and fertilizer on grain potassium uptake is shown in the table-1. The levels of vermicompost i.e. 1.25 t/ ha , 2.5 t/ ha , 3.75 t/ ha recorded significantly higher grain potassium uptake over no vermicompost level. The fertilizer levels of 50 and 100 % RDF also gave significantly superior grain potassium uptake over no fertilizer level. The interactions among the different levels of vermicompost and fertilizer were found significant. The integrated application of vermicompost (3.75 t/ ha) + 100 % NPK showed the significant higher amount of grain nitrogen uptake i.e. 112.06 mg/ pot , which was statistically at par with vermicompost 2.5 t/ ha and 100 % RDF i.e. 109.17 mg/ pot .The added organic manure might have enhanced beneficial micro flora thus uptake increased (Meena *et al*. 2010) and supporting study was given by (Krishna *et al.,* 2018).

Straw nitrogen uptake (mg/ pot):

The influence of different levels of vermicompost and fertilizer on the straw nitrogen uptake is presented in the table-2. The straw nitrogen uptake varied from 153.97 to 252.00 mg/ pot with different levels of vermicompost, irrespective of fertilizer levels. The straw potassium uptake in accordance to the different fertilizer levels ranged between 143.38 to 264.10 mg/ pot , irrespective of vermicompost levels. The vermicompost levels recorded significantly higher straw nitrogen uptake over no vermicompost level. The 50 and 100 % RDF levels also gave significantly higher straw nitrogen uptake over no fertilizer level. The interactions in between vermicompost and fertilizer levels were found significant. The elevated Straw nitrogen uptake was found in the treatment receiving (vermicompost-3.75 t/ ha + 100% RDF) i.e. 303.81 mg/ pot which was significantly superior over control (no vermicompost + 0% RDF) i.e. 94.20 mg/ pot and relative result was found out by (Masni and Wasli, 2019).

Straw phosphorus uptake (mg/ pot):

The table-2 showed different levels of vermicompost and fertilizer on straw phosphorus uptake**.** The straw phosphorus uptake varied 23.67 to 40.21 mg/ pot with different levels of vermicompost, irrespective of fertilizer levels. Irrespective of vermicompost levels, the straw phosphorus uptake in accordance to the different fertilizer levels ranged between 21.71 to 42.66 mg/ pot. The vermicompost levels recorded significantly higher straw phosphorus uptake over no vermicompost level. The 50 and 100 % RDF levels also gave significantly higher straw phosphorus uptake over no fertilizer level.

The interactions in between vermicompost and fertilizer levels were found significant. The elevated straw phosphorus uptake was found in the treatment receiving (vermicompost-3.75 t/ ha + 100% RDF) i.e. 49.83 mg/ pot which was significantly superior over control (vermicompost-no manure + 0% RDF) i.e. 14.31 mg/ pot.

The increase in straw phosphorus uptake might be due to the mineralization of nutrients by the favourable micro flora and availability of nutrients increased the uptake by the plant thus increased Straw phosphorus uptake .Similar findings were observed by Chesti *et al.* (2013) and close observation was given by (Krishna *et al.,* 2018).

Straw potassium uptake (mg/ pot):

The effect of different levels of vermicompost and fertilizer on straw potassium uptake is presented in the table-2. The straw potassium uptake varied from 210.73 to 482.70 mg/ pot with different levels of vermicompost, irrespective of fertilizer levels. Irrespective of vermicompost levels, the straw potassium uptake in accordance to the different fertilizer levels ranged between 240.05 to 454.37 mg/pot. The vermicompost levels i.e. 1.25 t/ ha, 2.5 t/ ha and 3.75 t/ ha recorded significantly higher straw potassium uptake over no vermicompost level. The 50 and 100 % RDF levels also gave

Table 1: Effect of vermicompost and fertilizer on grain nutrients (N, P and K) uptakes of rice crop during growth period

Treatments	N uptake (mg/ pot)				P uptake (mg/ pot)				K uptake (mg/ pot)			
	F_0	F_{100}	F_{50}	Mean	F_0	F_{100}	F_{50}	Mean	F_0	F_{100}	F_{50}	Mean
V_0	133.47	283.28	205.19	**207.31**	24.28	63.65	42.18	**43.37**	36.33	67.68	52.90	**52.30**
$V_{1.25}$	170.78	350.33	274.46	**265.19**	31.95	83.18	60.20	**58.44**	46.17	90.76	72.76	**69.90**
$V_{2.5}$	248.13	430.88	354.78	**344.60**	56.39	100.58	86.05	**81.01**	68.52	109.17	92.00	**89.90**
$V_{3.75}$	279.05	446.03	417.34	**380.81**	65.75	104.95	98.54	**89.75**	72.54	112.06	98.99	**94.53**
Mean	**207.86**	**377.63**	**312.94**		**44.59**	**88.09**	**71.74**		**55.89**	**94.92**	**79.16**	
Factors	CD (5%)		SEm(±)		CD (5%)		SEm(±)		CD (5%)		SEm(±)	
Vermicompost(V)	11.39		3.88		2.66		0.91		2.82		0.96	
Fertilizers(F)	9.86		3.36		2.30		0.78		2.44		0.83	
V X F	19.72		6.72		4.60		1.57		4.88		1.66	

Table 2: Effect of vermicompost and fertilizer on straw nutrient (N, P and K) uptakes of rice crop during growth period

Treatments	N uptake (mg/ pot)				P uptake (mg/ pot)				K uptake (mg/ pot)			
	F_0	F_{100}	F_{50}	Mean	F_0	F_{100}	F_{50}	Mean	F_0	F_{100}	F_{50}	Mean
V_0	94.20	209.40	158.32	**153.97**	14.31	33.91	22.81	**23.67**	143.33	287.13	201.74	**210.73**
$V_{1.25}$	121.77	256.37	213.47	**197.21**	20.12	41.35	32.77	**31.41**	200.19	429.83	330.18	**320.07**
$V_{2.5}$	173.82	286.80	236.93	**232.52**	24.06	45.54	37.50	**35.70**	274.89	521.73	456.48	**417.70**
$V_{3.75}$	183.71	303.81	268.48	**252.00**	28.35	49.83	42.44	**40.21**	341.78	578.78	527.52	**482.70**
Mean	**143.38**	**264.10**	**219.30**		**21.71**	**42.66**	**33.88**		**240.05**	**454.37**	**378.98**	
Factors	CD (5%)		SEm(±)		CD (5%)		SEm(±)		CD (5%)		SEm(±)	
Vermicompost(V)	7.67		2.61		1.22		4.78		14.05		4.78	
Fertilizers(F)	6.64		2.26		1.05		4.14		12.16		4.14	
V X F	13.29		4.53		2.11		8.29		24.33		8.29	

V_0= Vermicompost (no manure), $V_{1.25}$= Vermicompost (1.25 t ha^{-1}), V2.5= Vermicompost (2.5 t ha^{-1}), $V_{3.75}$ = Vermicompost (3.75 t ha^{-1}), F_0= Fertilizer (no fertilizer), F_{100}= Fertilizer (100%RDF), F_{50}= Fertilizer (50 % RDF) and V_0F_0 = control (no vermicompost + no fertilizer).

significantly higher straw potassium uptake over no fertilizer level. The interactions between vermicompost and fertilizer levels were found significant. The integrated application of vermicompost (3.75 t/ ha) + 100 % NPK showed always the significant higher amount of straw potassium uptake i.e. 578.78 mg/ pot at post-harvest over the control (143.33 mg/ pot) and relative study was done by (Krishna *et al.,* 2018).

Total nitrogen uptake (mg/ pot):

The influence of different levels of vermicompost and fertilizer on the total nitrogen uptake is presented in the table-3. The vermicompost levels recorded significantly higher total nitrogen uptake over no vermicompost level. The 50 and 100 % RDF levels also gave significantly higher total nitrogen uptake over no fertilizer level. The interactions in between vermicompost and fertilizer levels were found significant. The elevated total nitrogen uptake was found in the treatment receiving (vermicompost-3.75 t/ ha + 100% RDF) i.e. 749.84 mg/ pot which was significantly superior over control (no vermicompost + no fertilizer) i.e. 227.67 mg/ pot .The increase in total nitrogen uptake might be due to the more availability of nitrogen to the plant in the soil thus enhanced nitrogen uptake and close finding in other crop due to vermicompost and fertilizer application was given by (Mahmud *et al.,* 2020).

Total phosphorus uptake (mg/ pot):

The (table-3) deals with influence of vermicompost and fertilizer levels on the total phosphorus content of rice crop in the pot experiment. The vermicompost of levels 1.25 t/ ha, 2.5 t/ ha and 3.75 t/ ha all were found significantly higher over no vermicompost level. The fertilizer levels of 50 % and 100 % RDF were found significantly superior over no fertilizer level. The combined application of highest level of vermicompost (3.75 t/ ha) + 100 % RDF showed total phosphorus uptake i.e. 0.083 mg/ pot , which was significantly superior over control (0.055 mg/ pot) but the interaction among the different levels of vermicompost and fertilizer was found non-significant.

Total potassium uptake (mg/ pot):

The data pertaining to total potassium uptake as influenced by vermicompost and fertilizer levels presented in table-3 is statistically significant. The levels of vermicompost of 1.25 t/ ha, 2.5 t/ ha and 3.75 t/ ha gave significantly higher total potassium uptake over no vermicompost level. The fertilizer of 50 % and 100 % RDF were significantly superior over no fertilizer level. The interactions among the levels of vermicompost and fertilizer were found significant. The integrated application of vermicompost (3.75 t/ ha) + 100 % NPK resulted in significant higher amount of total potassium uptake i.e. 690.84 mg/ pot at post-harvest over the control (179.66 mg/ pot) and supportive study was done by (Krishna *et al.,* 2018), along with close finding in other crop due to vermicompost and fertilizer application was given by (Mahmud *et al.,* 2020).

Apparent nitrogen use efficiency (%):

The influence of different levels of vermicompost and fertilizer on the apparent nitrogen use efficiency is presented in the table-4. The apparent nitrogen use efficiency varied from 28.21 to 63.16 % with application of different levels of vermicompost application, irrespective of fertilizer levels and with respect to application of different fertilizer levels ranged between 45.06 to 56.70 %, irrespective of vermicompost levels. The vermicompost level of 2.5 t/ ha recorded significantly higher apparent nitrogen use efficiency over rest of the vermicompost levels. The 50% RDF level also gave significantly higher apparent nitrogen use efficiency over 100 % RDF and no fertilizer level application. The interactions in between vermicompost and fertilizer levels were found significant. The elevated apparent nitrogen use efficiency was found in the treatment receiving (vermicompost-3.75 t/ ha + 50% RDF) i.e. 63.86 % which was significantly superior over. The increase in apparent nitrogen use efficiency might be due to the more availability of nitrogen to the plant in the soil thus enhanced nitrogen uptake (Manivannan *et al.,* 2020).

Apparent phosphorus use efficiency (%):

The data pertaining to apparent phosphorus use efficiency as influenced by vermicompost and fertilizer levels presented in table-4 are statistically significant. The apparent phosphorus use efficiency significantly increased with the application of vermicompost and varied between 14.47 to 28.61 %, irrespective of fertilizer application whereas it varied from 18.76 to 26.82 % with application of fertilizer, irrespective of vermicompost levels. The levels of vermicompost of 1.25 t/ ha, 2.5 t/ ha and

Table 3: **Effect of vermicompost and fertilizer on total nutrient uptakes of rice crop during growth period**

Treatments	Total N uptake (mg/ pot)				Total P uptake (mg/ pot)				Total K uptake (mg/ pot)			
	F_0	F_{100}	F_{50}	Mean	F_0	F_{100}	F_{50}	Mean	F_0	F_{100}	F_{50}	Mean
V_0	227.67	492.68	363.51	**361.29**	38.58	97.56	64.99	**67.04**	179.66	354.81	254.63	**263.03**
$V_{1.25}$	292.56	606.70	487.94	**462.40**	52.06	124.54	92.97	**89.86**	246.37	520.59	402.93	**389.96**
$V_{2.5}$	421.96	717.68	591.71	**577.12**	80.45	146.12	123.55	**116.71**	343.41	630.90	548.48	**507.60**
$V_{3.75}$	462.76	749.84	685.81	**632.80**	94.10	154.78	140.98	**129.95**	414.32	690.84	626.51	**577.22**
Mean	**351.24**	**641.72**	**532.24**		**66.30**	**130.75**	**105.62**		**295.94**	**549.29**	**458.14**	
Factors	CD (5%)		SEm(±)		CD (5%)		SEm(±)		CD (5%)		SEm(±)	
Vermicompost (V)	19.05		6.49		3.87		1.32		16.86		5.74	
Fertilizers (F)	16.50		5.62		3.35		1.14		14.60		4.97	
V X F	33.00		11.24		6.71		2.28		29.20		9.94	

Table 4: Effect of vermicompost and fertilizer on nutrient use efficiencies of rice crop during growth period

Treatments	Nitrogen use efficiency (%)				Phosphorus use efficiency (%)				Potassium use efficiency (%)			
	F_0	F_{100}	F_{50}	Mean	F_0	F_{100}	F_{50}	Mean	F_0	F_{100}	F_{50}	Mean
V_0	0.00	41.77	42.87	**28.21**	0.00	22.51	20.89	**14.47**	0.00	98.29	84.39	**60.89**
$V_{1.25}$	48.70	49.37	57.72	**51.93**	20.48	25.54	26.84	**24.29**	66.79	122.66	118.21	**102.55**
$V_{2.5}$	72.76	54.36	62.35	**63.16**	29.08	26.17	30.57	**28.61**	81.93	119.66	127.66	**109.75**
$V_{3.75}$	58.77	50.45	63.86	**57.69**	25.47	24.02	29.00	**26.16**	78.33	107.02	114.97	**110.11**
Mean	**45.06**	**48.99**	**56.70**		**18.76**	**24.56**	**26.82**		**56.76**	**111.91**	**111.31**	
Factors	CD (5%)		SEm(±)		CD (5%)		SEm(±)		CD (5%)		SEm(±)	
Vermicompost (V)	1.77		0.60		0.82		0.28		3.35		1.14	
Fertilizers (F)	1.53		0.52		0.71		0.24		2.90		0.99	
V x F	3.06		1.04		1.42		0.48		5.80		1.98	

V_0= Vermicompost (no manure), $V_{1.25}$= Vermicompost (1.25 t ha^{-1}), V2.5= Vermicompost (2.5 t ha^{-1}), $V_{3.75}$ = Vermicompost (3.75 t ha^{-1}), F_0= Fertilizer (no fertilizer) , F_{100}= Fertilizer (100% RDF), F_{50}= Fertilizer (50 % RDF) and V_0F_0 = control (no vermicompost + no fertilizer).

Table 5: Correlation coefficients (r) among yield of rice, nutrient content and nutrient uptake during pot experiment.

a. Grain yield and nutrients (N, P, K) contents and uptakes

Parameters	Grain yield	N uptake	P uptake	K uptake
Grain yield	1.000			
N uptake	0.990**	1.000		
P uptake	0.993**	0.997**	1.000	
K uptake	0.991**	0.993**	0.993**	1.000

b. Straw yield and nutrients (N, P, K) contents and uptakes

Parameters	Straw yield	N uptake	P uptake	K uptake
Straw yield	1.000			
N uptake	0.995**	1.000		
P uptake	0.992**	0.993**	1.000	
K uptake	0.955**	0.963**	0.963**	1.000

****Significant at P = 0.01 level** ***Significant at P = 0.05 level**

3.75 t/ ha gave significantly higher apparent phosphorus use efficiency over no vermicompost level. The fertilizer of 50 % and 100 % RDF were significantly superior over no fertilizer level application.

The interactions among the levels of vermicompost and fertilizer were found significant. The integrated application of vermicompost (2.5 t/ ha) + 50 % RDF resulted in significant higher amount of apparent phosphorus use efficiency i.e. 30.57 % at post-harvest over the control (Savaliya *et al.,* 2018) and (Manivannan *et al.,* 2020).

Apparent potassium use efficiency (%):

The effect of different levels of vermicompost and fertilizer on apparent potassium use efficiency is presented in the table-4 and is statistically significant. The apparent potassium use efficiency varied from 60.89 to 109.75 % with different vermicompost levels application, irrespective of fertilizer levels. Irrespective of vermicompost levels, the apparent potassium use efficiency with respect to the different fertilizer levels ranged between 56.76 to 111.91 %. The vermicompost levels i.e. 1.25 t/ ha , 2.5 t/ ha and 3.75 t/ ha recorded significantly higher apparent potassium use efficiency over no vermicompost level. The 50 and 100 % RDF levels also gave significantly higher apparent potassium use efficiency over no fertilizer level. The interactions regarding vermicompost and fertilizer levels were significant.

However the vermicompost of 2.5 t/ ha + 50 % RDF recorded higher apparent potassium use efficiency i.e. 127.66 %, which was statistically at par with the treatment receiving 1.25 t/ ha vermicompost and 100 % RDF (122.66 %).

The increase in apparent potassium use efficiency might be due to the better utilization of nutrients as well as reduction in loss of nutrients and thus increased apparent potassium use efficiency (Manivannan *et al.,* 2020).

Conclusion

Rice crop during its growth requires a large quantity of nutrients and balanced quantity of vermicompost along with fertilizer elevates the yield during harvesting of crop. Among different treatments higher dose of vermicompost (vermicompost-3.75 t/ha + 100% RDF) and fertilizer supplied better yield and uptake of nutrients and vermicompost (2.5 t/ ha) + 50 % RDF dose provided significant results in increasing nutrient use efficiencies. Combined application of vermicompost and fertilizer enhances nutrient content and uptake in grain, straw of crop, thus maximizing the efficiencies of nutrients that check the loss of nutrients and lower the cost of cultivation. Application of vermicompost is eco friendly, cost effective and balanced application with fertilizer helps in nutrient use efficiency and recycling in soil.

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Conflict of interest

The authors declare that they have no conflict of interest.

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