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National Academy of Agricultural Science (NAAS)
Rating : 3. 03

Effect of Different Vermicomposts on the Yield, Nutrient Uptake and Nitrogen Use Efficiency in Sri Method of Rice Cultivation

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Abstract: *Field experiments were conducted at Annamalai University, Experimental Farm, Annamalainagar, Chidambaram during two seasons to identify and evaluate different sources of vermicomposts on productivity enhancement, nutrient uptake and nitrogen use efficiency in low land rice under SRI method of cultivation The experiment comprised of eight treatments which includes recommend dose of fertilizer alone and in combination with vermicomposts prepared from various organic wastes namely Paddy straw, Coirpith, sewage sludge, Sugarcane trash, Pressmud and Crop residues @ 5t ha^{-1}. These were laid out in randomized block design and replicated thrice. Rice cultivar ADT 36 was used as test variety. The results revealed that crop raised with pressmud based vermicompost registered higher grain, straw yield and harvest index. The vermicompost treatments had significant influence on the nutrient uptake, Nitrogen use efficiency (NUE) and Economic nitrogen use efficiency (ENUE) over control and recommended dose of fertilizer by the crop at harvest. Among the different organic source of vermicompost, pressmud based vermicompost registered the highest N, P, K uptake, Nitrogen use efficiency (NUE) and Economic nitrogen use efficiency (ENUE) values at harvest. From the above experimental results, it could be concluded that with application of pressmud based vermicompost @ 5.0 t ha^{-1} not only resulted in higher yields but also superior in respect of nutrient uptake and nitrogen economy under SRI method of rice cultivation.*

Keywords: *SRI, Yield, Nutrient uptake, NUE, ENUE.*

INTRODUCTION

In India, rice occupies pivotal place and is the staple food of more than 70 per cent population. It accounts for about 45 per cent of total food grain production and 55 per cent of cereals production. It occupies about 44.6 million hectares with a production of 86.0 million tonnes and it continues to hold the key to sustain food production by contributing 20 to 25 per cent of agriculture GDP and assures food security in India for more than half of the total population. To feed the exploding population, projection of India's rice production target for 2025 AD is 140 millon tonnes, which can be achieved only by increasing the rice production by over 2.0 million tonnes per year in the coming decade (Subbiah, 2006). In contrast, recent slow down or plateauing of yield in irrigated rice was noticed as a result of soil health and decline in productivity level (IRCN, 2001). In recent years different combination of organic manures are used along with inorganics for sustaining the rice production and vermicompost was one among them which excels most.

In order to test the potential of vermicompost on the yield, nutrient uptake and nitrogen economy of the soil of rice, the present investigation was under taken.

MATERIALS AND METHODS

Field experiments were conducted at Experimental Farm, Annamalai University, Annamalainagar, during. Kuruvai' and Navarai 2014 to identify a suitable vermicompost derived from different sources of raw materials under SRI method of rice cultivation on grain and straw yields, nutrient uptake and nitrogen use effeciency of rice var.

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ADT 43. The experimental soil was deep clay, low in available soil nitrogen (192 kg ha^{-1}), medium in available soil phosphorus (21.7 kg ha^{-1}) and high in available soil potassium (275 kg ha^{-1}).

The experiment was laid out in randomized block design and replicated thrice. The experiment comprised of eight treatments with or without different sources of vermicompost. The different treatments includes, T_1-control (No fertilizers), T_2-Recommend dose of fertilizer alone, T_3 – T_2 + Paddy straw based vermicompost @ 5t ha^{-1}, T_4 – T_2 + Sewage based vermicompost @ 5t ha^{-1}, T_5 – T_2 + Coirpith based vermicompost @ 5t ha^{-1}, T_6 – T_2 + Sugarcane trash based vermicompost @ 5t ha^{-1}, T_7 – T_2 + Pressmud based vermicompost @ 5t ha^{-1}, and T_8 – T_2 + Crop residues based vermicompost @ 5t ha^{-1}.

Observations on grain and straw yield were recorded and Nitrogen use efficiency (NUE) and Economic nitrogen use efficiency (ENUE) were derived. Nitrogen use efficiency (NUE) was calculated in terms of seed yield per kg of nitrogen fertilizer applied and Economic nitrogen use efficiency (ENUE) was calculated in terms of seed yield per rupee invested on nitrogen fertilizers. Plants were also analysed for N, P and K uptake after harvest. The data on various studies recorded during the investigation were subjected to statistical scrutiny as suggested by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Results of the study revealed that among the various vermicompost treatments, substantial increase in grain and straw yields was realized in pressmud based vermicompost along with RDF (T_7) applied plots. Increased grain and straw yields of 101.53 and 46.05 per cent for season I and 112.53 and 47.99 per cent for season II, was recorded in RDF + pressmud based vermicomost applied plots over control. RDF + coir pith based vermicompost (T_5) follows the line next in order in respect of grain and straw yields. The aforesaid increased yields due to pressmud based vermicompost might be due to higher nutrient uptake and increased photosynthetic efficiency. In addition, the constant release of nitrogen from organic manure, particularly from vermicompost supplemented with NPK fertilizer might have satisfied the demand of the rice crop at every phenophase of rice crop. The least grain yield was recorded in no fertilizer plots (T_1).

In respect of harvest index, the treatments which receive pressmud based vermicompost recorded superior values which were followed by coirpith based vermicompost. The least values were recorded in absolute control. This might be ascribed to optimum plant vigour caused by pressmud vermicompost which favoured the portioning of the photosynthates to reproductive part that increased grain to straw ratio.

Table 1
Effect of different vermicomposts on grain yield, straw yield, harvest index in SRI rice

	Grain yield (kg ha^{-1})		*Straw yield (kg ha^{-1})*		*Harvest index*	
Treatments	*Season-I*	*Season-II*	*Season-I*	*Season-II*	*Season-I*	*Season-II*
T_1 - Control	2689.66	2710.00	4402.00	4672.33	37.92	38.46
T_2 - RDF alone	3504.66	3864.33	4731.66	5169.33	42.34	42.77
T_3 - T_2 + PS VC	3829.00	4295.00	5142.00	5716.33	42.68	42.90
T_4 - T_2 + S VC	4497.00	5026.66	5824.33	6273.66	43.60	44.48
T_5 - T_2 + CP VC	4904.66	5414.00	6127.66	6619.00	44.45	44.99
T_6 - T_2 + SC VC	4457.00	4842.33	5750.66	6269.33	43.66	43.58
T_7 - T_2 + PM VC	5420.00	5761.33	6429.33	6915.00	45.74	45.44
T_8 - T_2 + CR VC	3902.66	4459.00	5197.66	5718.66	42.88	43.81
SEd	150.10	66.59	45.85	40.20	0.86	0.86
CD(p = 0.05)	309.82	137.45	94.65	82.99	NS	NS

*RDF = Recommend Dose of Fertilizer, PSVC = Paddy Straw Based Vermicompost, SVC = Sewage Based Vermicompost, CPVC = Coirpith Based Vermicompost, SCVC = Sugar Cane Trash Based Vermicompost, PMVC = Pressmud Based Vermicompost, CRVC = Crop Residue Based Vermicompost

Table 2
Effect of different vermicomposts on nutrient uptake and nitrogen efficiencies in SRI rice

	Nitrogen uptake (kg ha^{-1})		*Phosphorus uptake (kg ha^{-1})*		*Potassium uptake (kg ha^{-1})*		*Nitrogen use efficiency*		*Economic nitrogen use efficiency*	
Treatments	*Season-I*	*Season-II*	*Season-I*	*Season-II*	*Season-I*	*Season-II*	*Season-I*	*Season-II*	*Season-I*	*Season-II*
T_1 - Control	98.93	101.53	15.66	17.76	98.13	118.23	22.41	24.33	2.24	2.43
T_2 - RDF alone	107.23	112.63	16.80	19.10	107.46	121.16	29.20	32.20	2.92	3.22
T_3 - T_2 + PS VC	114.16	117.86	18.10	20.13	116.86	124.70	32.93	35.79	3.15	3.58
T_4 - T_2 + S VC	121.03	124.96	20.23	22.93	122.83	128.10	37.47	41.21	3.75	4.15
T_5 - T_2 + CP VC	123.26	127.93	22.03	24.10	127.43	131.16	40.57	45.11	4.09	4.51
T_6 - T_2 + SC VC	120.06	123.90	19.90	22.93	121.73	127.56	37.47	40.35	3.71	4.03
T_7 - T_2 + PM VC	126.86	130.83	23.26	25.13	130.63	132.93	45.16	48.01	4.52	4.80
T_8 - T_2 + CR VC	115.00	118.86	18.40	20.73	117.16	124.90	32.52	37.15	3.25	3.71
SEdCD(P = 0.05)	1.032.12	0.661.37	0.541.12	0.440.91	0.591.23	0.470.98	0.661.38	1.242.57	0.100.22	0.120.25

*RDF = Recommend Dose of Fertilizer, PSVC = Paddy Straw Based Vermicompost, SVC = Sewage Based Vermicompost, CPVC = Coirpith Based Vermicompost, SCVC = Sugar Cane Trash Based Vermicompost, PMVC = Pressmud Based Vermicompost, CRVC = Crop Residue Based Vermicompost

Crop Nutrient Uptake/ Resource Utilization

Rice crop with different vermicomposts registered higher nutrient uptake and was significantly superior to recommended dose of fertilizer alone and absolute control.

The date on the effect of different vermicompost show that pressmud based vermicompost @ 5 t ha^{-1} (T_7) resulted in the highest N, P and K uptake in season I and season II, respectively by the rice crop. This might be due to the congenial environment in pressmud vermicompost for soil organisms involved in nitrogen transformation which has increased the available nitrogen status and retention capacity of nutrients and there by total nitrogen uptake by rice plant. Increase in available N due to application of pressmud based vermicompost was also reported by Rayar (1984).

Incorporation of pressmud increased the available 'P' status at a maximum level followed by composted coirpith. The organic acids released from pressmud solubalise fixed phosphorus from Fe and Al complexes in the soil during organic matter decay. The application of pressmud based vermi-compost also decreased the adsorption capacity and increased the soluble P and P desorp-tion in soil and this lends support to the higher uptake of P in pressmud based vermicompost treatments (Reddy *et al*., 1980).

Similar trend of higher K uptake was registered in treatment with application of pressmud based vermicompost with RDF. This increased uptake of K due to in pressmud based vermicompost might be due to the increased availability of K and also due to its higher K content in the compost.

In respect of nitrogen efficiency, the highest NUE was recorded in T_7 (RDF + Pressmud based vermicompost) as 45.16 for season I and 48.01 for season II, respectively. This was followed by T_5 (RDF + coirpith based vermicompost), The lowest values was observed in no fertilizer (T_1) plots. The ENUE (kg grain Rs 1 invested on N fertilizer) responded significantly to different treatments.

Among the treatments, the plots which receive RDF + pressmud based vermicompost (T_7) showed higher ENUE (4.52 for season I and 4.80 for season II, respectively). Application of RDF + coirpith based vermicompost (T_5) ranked second. The least value of ENUE was registered in treatment, T_1 (no fertilizer). Increased NUE and ENUE with pressmud based vermicompost could be due to adequate nutrient supply and there by crop nitrogen requirement was met throughout the crop growth period as opined by Balamurugan and Sudhakar (2012).

Thus from the present study it can be concluded that application of 5 t/ha pressmud based vermicompot along with recommended dose of fertilizers produces higher grain and straw yields, increases nutrient uptake along with conserving nitrogen in rice soils which pave way for sustainability in SRI method of rice cultivation.

References

Balamurugan, R and Sudhakar, P. (2012), Influence of Planting Methods and Different Vermicomposts on The Yield And Nitrogen Use Efficiency In Rice. Int. J. of Current Agri. Sci., 2(6): 24-27

Gomez, K.A., and Gomez, A.A, (1984), Statistical procedure for agricultural research (II Ed.) John Wiley and Sons, New York. pp. 680.

IRCN, (2001), Expert consultation on yield gap and productivity decline in rice production. Conclusion and recommendations. Int. rice Com. Newsletter, 50: 73-83.

Rayar, A.A. (1984), Physio-chemical properties of semi-arid soils incubated with different sources of organic manures. Madras Agric. J., 71: 43-47.

Reddy, K.R., K.R. Khaleel and M.R.Overcash. (1980), Nitrogen, phosphorus and carbon transformation in a coastal plain soil treated with animal manures. Agric. Wastes, 2: 225-228.

Subbaih, S.V, (2006), Rice-Several options being taped. The Hindu-Survey of Indian Agriculture, p.50-54.