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Influence of integrated nutrient management practices on soil properties of paddy (*Oryza sativa* L.) in coastal acid soil of Karnataka

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Abstract
A field experiment was conducted during *Kharif* 2019 at ZAHRS, Brahmavar, Udupi to know the effect of integrated nutrient management practices on soil properties of paddy in coastal acid soil of Karnataka. The experiment had 11 treatments and was triple-replicated in a randomised complete block design. The treatment comprised of recommended dose of fertilizer and absolute control for comparison along with supplemental addition of 50 and 25 percent of recommended dose of nitrogen applied through poultry manure, vermicompost, FYM, gliricidia and eupatorium. Application of 50 percent RDN through fertilizer and 50 percent RDN through poultry manure recorded significantly higher available phosphorus, secondary and micronutrients in soil after harvest of paddy crop. However, higher available soil nitrogen recorded in treatment applied with 50 percent RDN through fertilizer and 50 percent RDN through gliricidia and higher available soil potassium recorded in treatment applied with 50 percent RDN through fertilizer and 50 percent RDN through eupatorium. Application of 50 percent RDN through fertilizer and 50 percent RDN through vermicompost recorded significantly higher microbial load. Significantly higher total nitrogen, phosphorus, potassium and sulphur uptake was observed in 50 percent RDN through fertilizer + 50 percent RDN through poultry manure.

Keywords: Acid soil, eupatorium, gliricidia, paddy, poultry manure and vermicompost

Introduction

Sustainability of natural resources such as soil and water for crop production is a major challenge with burgeoning population pressure. There is a need to balance between increasing crop production without compromising soil health and environmental sustainability (Chauhan and Mahajan, 2012) [2]. In Asia, rice is the principal staple crop where ~90 percent of the global rice being grown and consumed (Kumar *et al*., 2018) [11]. In India, it occupies ~43.8 m ha of cultivable area with production of ~118.87 mt (Directorate of Economics and Statistics, 2021). Paddy is the prime crop in the coastal zone of Karnataka during *Kharif*.

In order to meet the food demands on a rising population in the century, farmers must manage nutrients and soil fertility in an integrated way. Required yield increases of major crops cannot be attained without ensuring that plants have an adequate, balanced supply of nutrients. Integrated nutrient management (INM) is an approach that seeks to both increase agricultural production and safeguard the environment for future generations. It is a strategy that incorporates both organic and inorganic plant nutrients to attain higher crop productivity, prevent soil degradation, and thereby help meet future food supply needs. INM with FYM, vermicompost, poultry manure, green manures and bio fertilizers along with chemical fertilizers are the alternative to restore the soil health and productivity. It is proven fact that organic manure is not a complete substitute for inorganic fertilizers and vice versa. Using both organic and in organic fertilizers is a workable way to save the costs and to maintain soil health resulting in sustained crop production. Singh and Kumar (2014) [21] reported increased yield and nutrient use efficiency in rice with organics. In addition to this, the conjunctive use of both sources as complementary and supplementary to each other will meet the nutritional deficiencies which are likely to occur due to continuous and intesive cultivation. Green manures are excellent and reliable alternative to chemical fertilizers for sustainable agriculture. It also increases organic carbon and improves physical properties like infiltration rate, bulk density and water content at field capacity. They add high organic matter and improve the soil fertility and productivity.

Plant growth-promoting rhizobacteria is a group of beneficial microorganism which colonizes the roots and exerts beneficial effects on plant growth and development. The use of PGPR is steadily improved in agriculture and offers an alternative way to supplement chemical fertilizers and pesticides by a wide variety of mechanisms. In acidic soils, lower availability of nutrients (N, P, K, Ca, Mg and S), higher nutrient losses due to leaching, volatilization and runoff has further aggravated the problem of nutrient management in rainfed paddy. Application of green manures imparts resilience to soil against moisture stress, improves soil quality, reduces soil erosion and pollution besides helping to reduce the use of chemical fertilizers. It minimizes the nitrous oxide (N_2O) and carbon dioxide (CO_2) emissions into the atmosphere and contributes an overall reduction in greenhouse gases (GHGs) and has far-reaching benefits in the climate change scenario (Wani *et al.*, 2003) [24].

Keeping in view the situation of the coastal zone of Karnataka, it is necessary to make use of the balanced supply of plant nutrients as a pre-requisite for successful agriculture. This can be achieved through integrated nutrient management for achieving sustainable yields and to maintain good soil physical environment to provide the required quantity of nutrients. Based on the availability of organic and green manures at the farmer's level, on experiment entitled Influence of integrated nutrient management practices on soil properties of paddy (*Oryza sativa* L.) in coastal acid soil of Karnataka.

Material and Methods

A field experiment was conducted at Seed Farm, Zonal Agricultural and Horticultural Research Station, Brahmavar, Udupi district, Karnataka. The experimental site is situated between 13^0 25' N latitude and 74^0 45' E longitude with an altitude of 10 meters above mean sea level. It comes under the coastal zone (agro-climatic zone 10) of Karnataka. The soil of the experimental site belongs to the textural class of "sandy loam" with a sand content of 71.20 percent, silt of 12.90 percent and clay of 15.90 percent. A composite soil sample was collected from the experimental site before the start of the experiment and analyzed for its physical, chemical properties of soil.

Field experiment was laid out in Randomized Complete Block Design (RCBD) with 11 treatments and three replications. Treatments consisting of different combinations of organic and inorganic nutrient sources *viz.*, T_1- Absolute control, T_2 - RDF (60:30:45 kg $N:P_2O_5:K_2O$ ha^{-1})**,** T_3 - 50 percent RDN through fertilizer + 50 percent RDN through FYM**,** T_4- 50 percent RDN through fertilizer + 25 percent RDN through FYM + 25 percent RDN through poultry manure**,** T_5- 50 percent RDN through fertilizer + 25 percent RDN through FYM + 25 percent RDN through vermicompost**,** T_6- 50 percent RDN through fertilizer + 25 percent RDN through FYM + 25 percent RDN through gliricidia**,** T_7- 50 percent RDN through fertilizer + 25 percent RDN through FYM + 25 percent RDN through eupatorium**,** T_8- 50 percent RDN through fertilizer + 50 percent RDN through poultry manure**,** T_9- 50 percent RDN through fertilizer + 50 percent RDN through vermicompost**,** T_{10}- 50 percent RDN through fertilizer + 50 percent RDN through gliricidia**,** T_{11}- 50 percent RDN through fertilizer + 50 percent RDN through eupatorium. Liquid plant growth promoting rhizomicrobial consortia is common for all treatment. Soil samples were collected before imposing treatments and at harvest of the crop. Soil samples were collected before imposing treatments and at harvest of the crop. Samples were air-dried in shade and samples were finely powdered using a wooden mallet, passed through a 2mm sieve and stored in polythene bags. Soil samples were analyzed for mechanical analysis and chemical properties by employing the standard method of analysis. Plant samples were collected at the time of harvest for analysis. Grain, leaf and straw were separated from the plant. The samples were initially air-dried at room temperature and dried at 60 °C in a hot air oven for 48hrs. Then powdered using a grinder fitted with stainless blades and preserved in polythene bags for further analysis. The rhizosphere soil samples collected from experimental soil were analyzed for different soil microorganisms *viz*., total bacteria, total fungi and total actinomycetes using standard dilution plate count technique and plating on specific nutrient media.

Results and Discussion

Soil physical properties

Bulk density of soil and soil porosity did not vary significantly among different INM practices. Lowest bulk density (1.32 Mg m^{-3}) and higher soil porosity (50.19 %) was reported in the received treatment, 50 percent RDN through fertilizer + 50 percent RDN through vermicompost. However, a numerically lower bulk density value was found in the treatment received by organic sources compared to those received by inorganic sources alone by nutrients as reported by Hesu *et al*. (2014) [9].

Soil chemical properties of paddy at harvest

Soil pH did not vary significantly among different INM practices. Higher soil pH (5.31) was recorded in the treatment which received, 50 percent RDN through fertilizer + 50 percent RDN through eupatorium. Due to integrated nutrient management practices, no significant differences have been found in soil electrical conductivity. However, it ranged from 0.05 dS m^{-1} in 50 percent RDN through fertilizer + 50 percent RDN through vermicompost treatment to 0.12 dS m^{-1} in 50 percent RDN through fertilizer + 50 percent RDN through poultry manure treatment. Drop in pH shortly after submergence as a consequence of the accumulation of carbon dioxide by produced by the respiration of aerobic bacteria and subsequently, increase pH of soil might be attributed to a reduction reaction involving the consumption of H^+ ions under submergence as reported by Ponnamperuma *et al.* (1966) [16]. The addition of manures along with inorganic fertilizers has been reported to increase the electrical conductivity of soil significantly (Subramanian and Kumaraswamy, 1989) [23].

The soil organic carbon differs significantly between the different treatments. Treatment (T_9) 50 percent RDN through fertilizer + 50 percent RDN through vermicompost recorded highest value (14.80 g kg^{-1}). The present results corroborate with the findings of Deshmukh *et al.* (2005) [5]. An increase in the organic carbon content of the soil in manure treated plots may be ascribed to the additive effect of partially decomposed organic matter (Gaurishankar *et al*., 2002 and Kong *et al.*, 2005) [8, 10].

Significant differences were observed in the soil nitrogen available after harvest of paddy. Highest soil available nitrogen (363.25 kg ha^{-1}) was observed in 50 percent RDN through fertilizer + 50 percent RDN through gliricidia. The role of green leaf manures in releasing N and improving N availability in soil was reported by Singh *et al.* (2008) [22]. Further, gliricidia leaf manuring facilitates in reducing the impact of rain on soil, minimizing the nutrient and soil losses.

Treatment 50 percent RDN through fertilizer + 50 percent RDN through eupatorium reported higher available K_2O (134.26 kg ha^{-1}) as compared with other treatments. However, eupatorium accumulates about 40 to 50 percent of the total absorbed K and its recycling would substantially save inorganic fertilizer and help soil K sustainability (Munir, 2014) [15].

Soil available P_2O_5 (68.18 kg ha^{-1}), exchangeable calcium [0.64 cmol (p^+) kg^{-1}], magnesium [0.40 cmol (p^+) kg^{-1}], available sulphur (10.02 mg kg^{-1}) and DTPA extractable micronutrients (Fe, Mn, Zn and Cu) was more with 50 percent RDN through fertilizer + 50 percent RDN through poultry manure (19.47, 4.55, 2.49 and 4.24 mg kg^{-1}, respectively). Higher availability of soil phosphorus in poultry manure applied treatment might be due to the coating of sesquioxides by poultry manure thus reduced the phosphorus fixing by soil and release of carbon dioxide and organic acids solubilizing the native soil phosphorus. This might be due to the mineralization of sulphur from organic matter and the release of sulphur from sulphur containing amino acids during decomposition of organic manures (Ponnamperuma, 1976) [17]. The addition of organic and green manures along with inorganic nutrients increased water-soluble calcium and magnesium levels in flooded soils as noticed by Prasad *et al.* (1996) [19]. Increased availability of Fe and Mn in soil may be attributed to the release of chelating agents during the decomposition of organic matter and their ability to form stable water-soluble complexes and preventing them from fixation by soil constituents. The addition of organic manures ascribed to the mineralization of organic manure and consequent release of complexing agents which might have prevented the Zn and Cu from precipitation and fixation in the soil. Similar findings were reported Ganapathi *et al.* (2016) [7] and Manivannan *et al*. (2017) [14].

Soil biological properties of paddy at harvest

Significantly higher bacterial population (28.51 cfu x 10^5 g^{-1} of soil), fungi population (41.48 cfu X 10^3 g^{-1} of soil) and actinomycetes population (18.38 cfu X 10^4 g^{-1} of soil) was found with 50 percent RDN through fertilizer + 50 percent RDN through vermicompost. RDF was found to have a slightly lower bacterial population (12.69), population of fungi (15.92) and actinomycetes population was found with RDF (11.62) compared with the rest of the treatments. The reason behind this could be due to the soil's increased organic carbon content due to organic manure application as compared with inorganic fertilizers. The results of the present study are in agreement with the findings of Sharada *et al* (2013) [20] reported higher soil microflora population *viz.*, bacteria, fungi and actinomycetes at different growth stages with the application of organic manures and RDF. Similar findings were also reported by Mallesha and Satyanarayana Rao (2017) [13].

Plant analysis of paddy at harvest

Significantly higher total nitrogen, phosphorus, potassium and sulphur uptake was observed in 50 percent RDN through fertilizer + 50 percent RDN through poultry manure (96.51, 39.09, 127.84 and 127.84 kg ha^{-1}, respectively). However, lower total nitrogen phosphorus, potassium and sulphur uptake was recorded in control (23.84, 8.94, 41.31 and 4.93 kg ha^{-1}, respectively). Poultry manure contained 60 percent of N as uric acid, which quickly changed to NH^{4+} for use by rice plants (Prabhakaran, 2000) [18]. The application of inorganic nutrients with poultry manure has led to an increase in the phosphorus content available in the soil. In these organic manures, the built-up of available phosphorus was higher, which could be due to the release of organic acid during microbial decomposition of organic matter, which may have contributed to the solubility of native phosphates, thus increasing the phosphorus pool available in the soil. Chng *et al*. (2016) [3] also an increase in P-concentration reported and uptake by the application of poultry manure. Eupatorium contains higher quantities of K, in the simple cationic form of K^+ (Li *et al.*, 2006) [12]. The increase in sulfur content can be attributed to the fact that the effect of organic acids produced during the decomposition process caused organic acids to precipitate sulfur impurities, which helped the sulfur to build up in the soil and to be taken up by the crops. The combined use of organic and inorganic fertilizers not only increased crop yields but also increased soil nutrient availability and crop uptake. Organic sources are known to have beneficial effects on soil structure, texture, tilting and facilitating rapid and increased availability of plant nutrients, thus creating a better environment for root growth and proliferation by creating more absorptive nutrient absorption surfaces. These findings were found in conformity with those of Dademal *et al*., 2004 [4] and Chattoo *et al*., 2009 [1].

Table 1: Initial soil physical, chemical and biological properties of the experimental site

Physical properties of soil			
Soil separates	**Sand**	**Silt**	**Clay**
	percent		
	71.20	12.90	15.90
Texture of soil	Sandy loam		
Bulk density (Mg m^{-3})	1.38		
Porosity	47.92		
Chemical properties of soil			
pH (1:2.5)	5.10		
EC (1:2) (dSm^{-1}) at 25 ºC	0.056		
Organic carbon (g kg^{-1})	11.20		
Available nitrogen (kg ha^{-1})	342.00		
Available P_2O_5 (kg ha^{-1})	60.30		
Available K_2O (kg ha^{-1})	110.40		
Exchangeable calcium [cmol (p^+) kg^{-1}]	0.98		

Exchangeable magnesium [cmol(p^+) kg^{-1}]	0.29
Available sulphur (mg kg^{-1})	11.46
DTPA Fe (mg kg^{-1})	14.31
DTPA Mn (mg kg^{-1})	3.11
DTPA Zn (mg kg^{-1})	1.41
DTPA Cu (mg kg^{-1})	1.97
Biological properties of soil	
Bacteria (cfu $\times10^5$ g^{-1} of soil)	13.10
Fungi (cfu $\times10^3$ g^{-1} of soil)	18.69
Actinomycetes (cfu $\times10^4$ g^{-1} of soil)	12.54

Table 2: Physical and chemical properties of soil after harvest of paddy as influenced by integrated nutrient management practices

Treatments	Physical properties		Chemical properties					
	BD (Mg m^{-3})	Porosity (%)	pH	EC (dSm^{-1})	OC (g kg^{-1})	Available N kg ha^{-1}	Available P_2O_5 kg ha^{-1}	Available K_2O kg ha^{-1}
T_1	1.38	47.92	4.72	0.07	8.70	289.43	31.19	92.55
T_2	1.39	47.55	5.02	0.06	10.30	316.91	38.26	106.48
T_3	1.34	49.43	4.97	0.06	12.90	326.09	41.71	112.34
T_4	1.35	49.06	5.18	0.08	12.60	332.57	62.69	123.19
T_5	1.34	49.43	5.00	0.07	14.60	336.61	49.15	120.08
T_6	1.36	48.68	5.25	0.07	13.50	358.54	46.08	122.76
T_7	1.36	48.68	5.24	0.06	13.20	340.31	47.74	128.28
T_8	1.33	49.81	5.10	0.12	13.40	348.83	68.18	130.97
T_9	1.32	50.19	5.17	0.05	14.80	353.12	60.34	123.75
T_{10}	1.34	49.43	5.13	0.06	14.10	363.25	57.61	123.27
T_{11}	1.35	49.06	5.31	0.06	13.80	351.56	52.43	134.26
S. Em.±	0.04	1.25	0.31	0.03	1.10	9.33	6.00	6.77
C.D. at 5%	NS	NS	NS	NS	3.30	27.38	17.61	19.86

Note: T_1- Absolute control, T_2 –Recommended dose of fertilizer (60:30:45 kg N:P_2O_5:K_2O ha^{-1}), T_3 - 50 percent recommended dose of nitrogen(RDN) through fertilizer + 50 percent RDN through FYM, T_4- 50 percent RDN through fertilizer + 25 percent RDN through FYM + 25 percent RDN through poultry manure, T_5- 50 percent RDN through fertilizer + 25 percent RDN through FYM + 25 percent RDN through vermicompost, T_6- 50 percent RDN through fertilizer + 25 percent RDN through FYM + 25 percent RDN through gliricidia, T_7- 50 percent RDN through fertilizer + 25 percent RDN through FYM + 25 percent RDN through eupatorium, T_8- 50 percent RDN through fertilizer + 50 percent RDN through poultry manure, T_9- 50 percent RDN through fertilizer + 50 percent RDN through vermicompost, T_{10}- 50 percent RDN through fertilizer + 50 percent RDN through gliricidia, T_{11}- 50 percent RDN through fertilizer + 50 percent RDN through eupatorium.

Table 3: Secondary and DTPA extractable micronutrients status of soil after harvest of paddy as influenced by integrated nutrient management practices

Treatments	Exchangeable Ca [cmol (p^+) kg^{-1}]	Exchangeable Mg [cmol (p^+) kg^{-1}]	Available S (mg kg^{-1})	Fe (mg kg^{-1})	Mn (mg kg^{-1})	Zn (mg kg^{-1})	Cu (mg kg^{-1})
T_1	0.28	0.18	5.27	9.65	2.17	0.89	1.05
T_2	0.42	0.23	7.02	14.30	3.06	1.34	1.86
T_3	0.63	0.28	7.98	17.01	3.32	1.59	2.24
T_4	0.61	0.38	9.47	14.58	3.65	1.90	3.37
T_5	0.56	0.36	9.14	15.42	3.68	1.86	3.14
T_6	0.52	0.30	8.66	15.70	3.35	1.73	2.90
T_7	0.55	0.34	8.39	15.93	3.38	1.78	2.97
T_8	0.64	0.40	10.02	19.47	4.55	2.49	4.24
T_9	0.62	0.38	9.85	18.92	4.29	2.32	4.03
T_{10}	0.47	0.35	8.83	16.22	4.07	2.25	3.50
T_{11}	0.51	0.35	8.78	16.61	3.82	2.13	3.78
S. Em.±	0.07	0.04	0.68	0.63	0.20	0.25	0.51
C.D. at 5 %	0.19	0.12	2.02	1.85	0.60	0.74	1.53

Note: T_1- Absolute control, T_2 –Recommended dose of fertilizer (60:30:45 kg N:P_2O_5:K_2O ha^{-1}), T_3 - 50 percent recommended dose of nitrogen(RDN) through fertilizer + 50 percent RDN through FYM, T_4- 50 percent RDN through fertilizer + 25 percent RDN through FYM + 25 percent RDN through poultry manure, T_5- 50 percent RDN through fertilizer + 25 percent RDN through FYM + 25 percent RDN through vermicompost, T_6- 50 percent RDN through fertilizer + 25 percent RDN through FYM + 25 percent RDN through gliricidia, T_7- 50 percent RDN through fertilizer + 25 percent RDN through FYM + 25 percent RDN through eupatorium, T_8- 50 percent RDN through fertilizer + 50 percent RDN through poultry manure, T_9- 50 percent RDN through fertilizer + 50 percent RDN through vermicompost, T_{10}- 50 percent RDN through fertilizer + 50 percent RDN through gliricidia, T_{11}- 50 percent RDN through fertilizer + 50 percent RDN through eupatorium.

Table 4: Biological properties of soil after harvest of paddy as influenced by integrated nutrient management practices

Treatments	Bacteria (cfu x 10^5 g^{-1} of soil)	Fungi (cfu x 10^3 g^{-1} of soil)	Actinomycetes (cfu x 10^4 g^{-1} of soil)
T_1	9.94	10.56	7.18
T_2	12.69	15.92	11.62
T_3	19.51	21.30	15.06
T_4	18.37	25.84	15.32
T_5	25.94	39.51	16.85
T_6	21.79	31.23	16.60
T_7	23.38	32.45	15.78
T_8	19.78	28.70	15.49
T_9	28.51	41.48	18.38
T_{10}	24.29	36.77	16.40
T_{11}	25.74	34.34	16.27
S. Em.±	3.48	6.45	1.55
C.D. at 5 %	10.22	18.93	4.56

Note: T_1- Absolute control, T_2 –Recommended dose of fertilizer (60:30:45 kg N:P_2O_5:K_2O ha^{-1})**,** T_3 - 50 percent recommended dose of nitrogen(RDN) through fertilizer + 50 percent RDN through FYM**,** T_4- 50 percent RDN through fertilizer + 25 percent RDN through FYM + 25 percent RDN through poultry manure**,** T_5- 50 percent RDN through fertilizer + 25 percent RDN through FYM + 25 percent RDN through vermicompost**,** T_6- 50 percent RDN through fertilizer + 25 percent RDN through FYM + 25 percent RDN through gliricidia**,** T_7- 50 percent RDN through fertilizer + 25 percent RDN through FYM + 25 percent RDN through eupatorium**,** T_8- 50 percent RDN through fertilizer + 50 percent RDN through poultry manure**,** T_9- 50 percent RDN through fertilizer + 50 percent RDN through vermicompost**,** T_{10}- 50 percent RDN through fertilizer + 50 percent RDN through gliricidia**,** T_{11}- 50 percent RDN through fertilizer + 50 percent RDN through eupatorium.

Table 5: Nitrogen, phosphorus, potassium and sulphur uptake (kg ha^{-1}) of paddy as influenced by integrated nutrient management practices

Treatments	Nitrogen uptake (kg ha^{-1})			P_2O_5 uptake (kg ha^{-1})			K_2O uptake (kg ha^{-1})			S uptake (kg ha^{-1})		
	Grain	Straw	Total	Grain	Straw	Total	Grain	Straw	Total	Grain	Straw	Total
T_1	17.16	16.68	23.84	4.82	4.12	8.94	17.38	23.93	41.31	2.42	2.51	4.93
T_2	44.18	27.23	71.41	12.28	12.82	25.10	39.06	58.17	97.23	7.20	8.62	15.82
T_3	51.31	32.87	84.18	15.41	17.08	32.49	44.19	63.68	107.87	11.22	12.22	23.44
T_4	52.98	33.29	86.27	16.61	18.46	35.07	46.95	67.58	114.53	11.64	12.84	24.48
T_5	54.49	33.60	88.09	16.47	17.68	34.15	46.92	63.45	110.37	11.61	12.58	24.19
T_6	42.43	23.50	65.93	13.48	12.61	26.09	38.77	49.76	88.53	9.08	10.06	19.14
T_7	45.35	25.46	70.81	14.22	13.95	28.17	43.30	61.18	104.48	9.58	10.72	20.30
T_8	57.57	38.94	96.51	18.12	20.97	39.09	52.11	75.73	127.84	12.97	14.77	27.74
T_9	56.05	38.33	94.38	17.23	19.98	37.21	45.84	74.59	120.43	12.45	14.27	26.72
T_{10}	47.52	26.51	74.03	14.77	15.47	30.24	41.59	56.62	98.21	10.64	11.64	22.28
T_{11}	53.59	34.73	88.32	16.26	18.36	34.62	49.65	74.59	124.24	11.84	13.29	25.13
S. Em.±	2.65	2.13	4.87	1.62	1.82	3.14	2.26	4.01	5.81	1.39	1.40	2.79
C.D. at 5 %	7.78	6.25	14.29	4.77	5.35	9.22	6.63	11.77	17.05	4.09	4.13	8.19

Note: T_1- Absolute control, T_2 –Recommended dose of fertilizer (60:30:45 kg N:P_2O_5:K_2O ha^{-1})**,** T_3 - 50 percent recommended dose of nitrogen(RDN) through fertilizer + 50 percent RDN through FYM**,** T_4- 50 percent RDN through fertilizer + 25 percent RDN through FYM + 25 percent RDN through poultry manure**,** T_5- 50 percent RDN through fertilizer + 25 percent RDN through FYM + 25 percent RDN through vermicompost**,** T_6- 50 percent RDN through fertilizer + 25 percent RDN through FYM + 25 percent RDN through gliricidia**,** T_7- 50 percent RDN through fertilizer + 25 percent RDN through FYM + 25 percent RDN through eupatorium**,** T_8- 50 percent RDN through fertilizer + 50 percent RDN through poultry manure**,** T_9- 50 percent RDN through fertilizer + 50 percent RDN through vermicompost**,** T_{10}- 50 percent RDN through fertilizer + 50 percent RDN through gliricidia**,** T_{11}- 50 percent RDN through fertilizer + 50 percent RDN through eupatorium.

Conclusion

Any technology or invention must be economically viable, technically practical, and socially acceptable for it to be successfully adopted in agriculture. From the current field experiment, it can be inferred that the best integrated approaches to nutrient management can be attained by advising the 50% RDN through fertiliser + 50% RDN through poultry manure with effective utilisation of microbial consortia in the paddy crop cultivation in acid soils of coastal Karnataka. It was discovered to be the most successful in terms of soil fertility, profitability and sustainable rice production.

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