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Study of effective microorganisms (EM) on different organic wastes and their effect on growth and yield of rice

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Abstract

Field experiment was conducted during May to September, 2010 to study the influence of Effective Microorganisms (EM) on different organic wastes *viz*., pressmud, sewage sludge, poultry manure and FYM on growth and yield of rice. Significantly higher plant height, number of tillers/m^2 and DMP was recorded in treatments applied with 25% N through EM inoculated poultry manure compost + 75% recommended dose of fertilizer N. It also recorded highest panicle number/m^2.The same treatment recorded highest grain and straw yield of 5350 kg ha^{-1} and 6788 kg ha^{-1} and whereas the lowest yield was recorded in control (2170 kg ha^{-1} grain and 3472 kg ha^{-1} straw yield).

Key-Words: Rice, Effective microorganisms (EM), FYM, Poultry manure, Pressmud

Introduction

Rice (*Oryza sativa*) is one of the most predominant food crops that is being extensively cultivated in India. More than 90 per cent of the world's rice is grown and consumed in Asia. India is the primary , has the leading position in acreage and next to China in production. However, yield levels in India are low at 2.20 tonnes per hectare compared to other major rice producing countries such as Japan (6.50 t/ha), China (6.70 t/ha), Egypt (7.50 t/ha) and Israel (5.50 t/ha) (Harikarasuthan, 2011). The planning commission estimates that our country requires 122.1 million tonnes of rice by 2020, to meet food security norms (Prabhakaran Nair, 2011). Self-sufficiency in rice production has been a major goal of agricultural research and development in most of the countries. Continuous use of high analysis fertilizers, improved varieties and plant protection chemicals cause several hazards to soil health which ultimately resulted in the reduction of crop yields. In the coming decades, a major issue in designing sustainable agricultural systems will be the management of soil organic matter and the rational use of organic inputs such as animal manures (FYM), poultry waste, sewage waste, industrial waste (pressmud). Effective microorganisms (EM) consists of mixed cultures of beneficial and naturally – occurring microorganism which includes both aerobic and anaerobic species co-existing symbiotically in a most beneficially productive manner It mainly consists of lactic acid bacteria (*Lactobacillus* spp), yeast (*Saccharomyces* spp), and photysynthetic bacteria (*Rhodopseudomeonas* spp) which co-exist for the benefit of whichever environment they are introduced. This when applied as inoculants it will improve the soil quality and plant growth. Keeping this in view a study was conducted to identify the effect of EM on different organic manure and their effect on growth and yield of rice.

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Material and Methods

The field experiment was conducted during May to September, 2010 in the experimental farm, Department of Agronomy, Annamalai University. The clay loam soil had pH of 7.8 and electrical conductivity of 0.27 d s/m. The initial soil available nitrogen content was low, while available phosphorus was medium and potassium was high. The experiment was conducted with ten treatments and replicated thrice in a randomized block design. They includes, control (T_1), recommended dose of fertilizer (T_2), 25% N through pressmud compost + 75% recommended dose of fertilizer N (T_3), 25% N through sewage compost + 75% recommended dose of fertilizer N (T_4), 25% N through poultry manure compost + 75% recommended dose of fertilizer N (T_5), 25% N through FYM + 75% recommended dose of fertilizer N (T_6), 25% N through EM inoculated pressmud compost + 75% recommended dose of fertilizer N (T_7), 25% N through EM inoculated sewage compost + 75% recommended dose of fertilizer N (T_8), 25% N through EM inoculated poultry manure compost + 75% recommended dose of fertilizer N (T_9) and 25% N through EM inoculated FYM + 75%

recommended dose of fertilizer N (T_{10}). All the compost were applied before transplanting of rice. Full dose of P_2O_5 and K_2O along with 50% of N were applied as basal to rice crop. Remaining N was top – dressed in 2 equal splits, at maximum tillering and panicle initiation stage. The short duration rice cv ADT 43 was transplanted with a spacing of 15cm x 10cm. The different sources of organic wastes were collected and allowed for 3 months for decomposition, then used as compost as per treatments. EM compost, the activated effective microorganism was prepared from the mother solution and inoculated with different sources of organic wastes which were 15 days old. After 6 weeks the decomposed materials were applied to experimental plots as per treatment requirement.

Results and Discussion

=Growth parameters (Table.1)

Plant height

Application of different composts with chemical fertilizers significantly influenced on plant height at harvest stage of rice. The treatment T_9-25% N through EM (effective microorganisms) inoculated poultry manure compost + 75% recommended dose of fertilizer N, registered higher plant height of 102.10 cm. This was on par with the treatment T_7 which receives 25% N through EM inoculated pressmud compost + 75% recommended dose of fertilizer N recorded the higher plant height. The control treatment T_1- recorded lowest plant height of 75.45cm at harvest.

Number of tillers m^{-2}

The numbers of tillers m^{-2} in rice crop was recorded at harvest. The treatments of various composts with chemical fertilizer application exhibited significant influence on number of tillers m^{-2} at harvest stage. Treatment T_9-25% N through EM inoculated poultry manure compost + 75% recommended dose of fertilizer N, registered significantly higher number of tillers m^{-2} of 821.70. This treatment was followed by T_7- 25% N through EM inoculated pressmud compost + 75% recommended dose of fertilizer N recorded the higher number of tillers m^{-2} and on par with treatment 25% N through EM inoculated sewage compost + 75% recommended dose of fertilizer N(T_8). The control treatment (T_1) recorded lowest number of tillers m^{-2} of 481.80 at harvest.

Dry matter Production

The dry matter production (DMP) of rice was recorded at harvest. Various composts along with chemical fertilizer application exhibited significant differences on DMP. Treatment T_9- 25% N through EM inoculated poultry manure compost + 75% recommended dose of fertilizer N, recorded significantly higher DMP of 11985.50 kg ha^{-1}. This treatment was closely followed by T_7-25% N through EM inoculated pressmud compost + 75% recommended dose of fertilizer N recorded the higher DMP. The treatment T_1 (control) recorded lowest DMP of 5492.00 kg ha^{-1} at harvest. EM stimulates quick decomposition of organic material and mineralization of nutrients from applied organic manures which enhance the plant growth parameters. These results are in accordance with the findings of Daly and Stewart (1999) and miller and Helen (2007).

Yield parameter (Table.2)

Number of panicles m^{-2}

Significant influence on number of panicles m^{-2} at harvest was noted due to application of various composts along with chemical fertilizer. Among the treatments, T_9- 25% N through EM inoculated poultry manure compost + 75% recommended dose of fertilizer N, recorded significantly higher number of panicles m^{-2} of 504.75. This was followed by the treatment T_7- 25% N through EM inoculated pressmud compost + 75% recommended dose of fertilizer N recorded the higher number of panicles m^{-2}. The control treatment (T_1) recorded lowest number of panicles m^{-2} of 274.55. Higher tiller production in the early stage and steady supply of nutrients through mineralization of EM inoculated poultry manure compost might have contributed for higher panicle production (Jayabal and Kuppuswamy, 2001).

Grain yield

Rice grain yield was significantly influenced by application of different composts with chemical fertilizers. Among the treatments, treatment T_9- 25% N through EM inoculated poultry manure compost + 75% recommended dose of fertilizer N, recorded significantly higher grain yield of 5350 kg ha^{-1}. This was followed by the treatment T_7- 25% N through EM inoculated pressmud compost + 75% recommended dose of fertilizer N recorded the higher grain yield. The control treatment (T_1) recorded lowest grain yield of 2170 kg ha^{-1} at harvest. Higher tiller production in the early stage and steady supply of nutrients through mineralization of EM inoculated poultry manure compost might have contributed for higher panicle production and number of filled grains $panicle^{-1}$, which ultimately increase grain yield of rice (Piqueres *et al.*, 2005).

Straw yield

Application of composts with chemical fertilizers treatments had profound influence on rice straw yield. Among the various treatments, treatment T_9-25% N through inoculated poultry manure compost + 75% recommended dose of fertilizer N, registered significantly higher straw yield of 6788 kg ha^1 at harvest. This was closely followed by the treatment T_7-

25% N through EM inoculated pressmud compost + 75% recommended dose of fertilizer N recorded the higher straw yield. It was on par with the treatment T_8- 25% N through EM inoculated sewage compost + 75% recommended dose of fertilizer N. The control treatment (T_1) recorded lowest straw yield 3472 kg ha^{-1}. The EM suppress pathogenic species while facilitating the decomposition of organic materials and synthesizing nutrients essential for plant growth.

From the results it indicated that application of organic sources of nutrients such as pressmud, sewage, poultry manure, FYM and EM inoculated composts along with inorganic fertilizer performed well in increasing the rice yield than no organic manures without deterioration of soil health. Among the different EM inoculated compost, combination of 25% N through EM inoculated poultry manure compost along with 75% recommended dose of fertilizer N produced the higher rice grain yield in rice.

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Table 1: Effect of effective microorganisms inoculated organic waste and their effect on growth parameters of rice at harvest

Treatments	Plant height (cm)	Number of tillers m^{-2}	DMP (kg/ha)
T_1 – Control	75.45	481.80	5492.00
T_2 – Recommended dose of fertilizer	79.45	529.32	8965.00
T_3 – 25% N through pressmud compost + 75% recommended dose of fertilizer N	89.03	649.44	10610.00
T_4 – 25% N through sewage compost + 75% recommended dose of fertilizer N	82.45	594.00	10101.70
T_5 – 25% N through poultry manure compost + 75% recommended dose of fertilizer N	93.83	704.22	10852.00
T_6 – 25% N through FYM + 75% recommended dose of fertilizer N	79.45	579.48	9525.75
T_7 – 25% N through EM inoculated pressmud compost + 75% recommended dose of fertilizer N	101.03	781.44	11463.86
T_8 – 25% N through EM inoculated sewage compost + 75% recommended dose of fertilizer N	96.93	747.78	11074.60
T_9 – 25% N through EM inoculated poultry manure compost + 75% recommended dose of fertilizer N	102.10	821.70	11985.50
T_{10} – 25% N through EM inoculated FYM + 75% recommended dose of fertilizer N	85.40	642.84	10452.00
SEd	2.01	19.80	237.14
CD (P = 0.05)	4.24	41.58	498.01

Table 2: Effect of effective microorganisms inoculated different organic waste and their effect on yield parameters of rice

Treatments	Number of panicles m^{-2}	Grain yield(kg ha^{-1})	Straw yield (kg ha^{-1})
T_1 – Control	274.55	2170	3472
T_2 – Recommended dose of fertilizer	302.45	4170	5840
T_3 – 25% N through pressmud compost + 75% recommended dose of fertilizer N	413.12	4680	6183
T_4 – 25% N through sewage compost + 75% recommended dose of fertilizer N	362.74	4308	6018
T_5 – 25% N through poultry manure compost + 75% recommended dose of fertilizer N	443.12	4874	6284
T_6 – 25% N through FYM + 75% recommended dose of fertilizer N	335.12	4262	5922
T_7 – 25% N through EM inoculated pressmud compost + 75% recommended dose of fertilizer N	483.75	5114	6500
T_8 – 25% N through EM inoculated sewage compost + 75% recommended dose of fertilizer N	461.12	4918	6367
T_9 – 25% N through EM inoculated poultry manure compost + 75% recommended dose of fertilizer N	504.75	5350	6788
T_{10} – 25% N through EM inoculated FYM + 75% recommended dose of fertilizer N	396.12	4521	6101
SEd	8.27	101	130
CD (P = 0.05)	17.38	212	273