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Research Article

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Growth and yield of Rice *Oryzae sativa* in response to organic sources FYM, Pressmud, Panchakavya and Dasagavya

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ABSTRACT

Field experiments were conducted at Annamalai Unversity, Experimental Farm, Annamalai Nagar, Chidambaram during the seasons viz., Kuruvai and Samba, 2013 to study the organic nutrient management in rice by using various organic sources (Organic manure, Panchagavya and Dasagavya).The experiment was laid out in a split plot design. For this organic source of nutrients assigned to main plot and foliar sprays to sub plot. Organic sources of nutrients viz., M_1 (Farm yard manure + RDF + BF, M_2 (Pressmud @12.5 t ha^{-1} + RDF + BF) and M_3 (control ,inorganic alone) in main plot and foliar application viz., S_1 (No spray), S_2 (3% Panchagavya, two times at tillering panicle initiation), S_3 (3% Panchagavya, three times at tillering panicle initiation, flowering), S_4 (3% Dasagavya, two times at tillering panicle initiation),) and S_5 (3% Dasagavya three times at tillering panicle initiation and flowering) under sub plot were evaluated. The treatments were replicated thrice. ADT 36 and Co43 were used as test varieties for appropriate seasons.The results of the study revealed that the application of pressmud @ 12.5 t ha^{-1} + RDF + BF enhanced the growth parameters viz., plant height, number of tillers m^{-2}, leaf area index, dry matter production, and yield attributes like productive tillers m^{-2} , panicle length, filled grains panicle^{-1} thousand grain weight, and yield. Among foliar spraying 3 % dasagavya for 3 times spraying recorded the highest growth and yield attributing characters compared to 3% Panchagavya for 3 times spraying and 3% dasagavya for 2 sprayings.Crop raised with pressmud @ 12.5 t ha^{-1} +RDF + BF registered the highest grain and straw yields among the organic sources. Application of organic sources and foliar spray had significant influence on the N, P and K uptake by the crop at harvest stages. Pressmud @ 12.5 t ha^{-1} +RDF +BF recorded the higher nutrient uptake followed by Farm yard manure @ 12.5 t ha^{-1} +RDF +BF. Among the foliar applications, 3 % dasagavya, three times at times at tillering panicle initiation, flowering registered the higher nutrient uptake at harvest stages. The same trend was followed in samba, 2013 also..Based on the above experimental results, it could be conculuded that cultivation of rice with pressmud @ 12.5 t ha^{-1} +RDF +BF along with foliar application of dasagavya, 3 sprayings was found to be a promising combination which resulted in higher yields and economic returns. Hence it can be concluded that this combination can be recommended to the rice growing farmers in the coastal areas of Tamil Nadu.

Keywords: *Oryza sativa, FYM, Organic sources,Crop.*

INTRODUCTION

Rice (*Oryza sativa*) is one of the most predominant food crops that are being extensively cultivated in India More than 90 per cent of the world's rice is grown and consumed in Asia. To fulfil the increased rice demand with shrinking resources, it is necessary to increase yield per unit area with sustainable and nutrient balance technology packages which would increase the rice production substantially without harming the precious environment. Nutrients supplied exclusively through chemical sources, though enhance yield initially lead to unsustainable productivity over the years (Mahajan *et al*., 2008) In view of escalating cost of fertilizers and their hazardous polluting effects on environment, there is awareness among the research workers about the alternate agricultural systems known as Biological farming or organic farming.

Nowadays, the sources of organic matter are scarce, due to shortage and non availability of labour to rear animals. Farm yard manure (FYM) is cheaper, locally available, contains macro, micro nutrients with essential nutrients (Elavazhagan, 2011). Industrial waste such as pressmud or fittel cake is the by product of sugar factories reported to be a valuable resource of plant nutrients and may therefore after the physical, chemical and biological properties of the soil. (Rang raj *et al.,* 2007; Jamil*et al.,* Muhammad and Khattak, 2009). Panchagavya, an organic source of nutrition being sought to improve crop establishment and health (Shakuntala *et al.,* (2012). Saritha *et al*., (2013) and Pathak and Ram (2012) also reported that panchagavya possess almost all major nutrients, micronutrients and growth hormones enhances the metabolic activity of plants and supports better seed invigoration. Dasagavya, is an organic preparation made from ten products in the form of panchagavya and certain plant extracts. Dasagavya so obtained has the potential to promote growth and boost immunity in the plant system against pests and diseases.However information on use of organic manures, panchagavya in combination with leaf extracts of endemic plants, dasagavya is very meager. In view of the above considerations, present study was conducted to examine the effect of FYM, Pressmud, foliar spray of Panchagavya and Dasagavya on the growth and yield of rice, at Annamalai university, Experimental Farm.

The field experiment was conducted in the field number A_5 at the Experimental Farm, Department of Agronomy, Annamalai University, Annamalainagar, Tamil Nadu. The Experimental Farm is situated at 11°24' N latitude and 79°44' E longitude at an altitude of +5.79 m above mean sea level. The weather at Annamalainagar is moderately warm with hot summer months. The rice crop (Kuruvai) received a rainfall of 270.8 mm distributed over 19 rainy days. The maximum temperature ranged from 34.4ºC to 39.1ºC with mean of 35.8ºC. The minimum temperature ranged from 21.1ºC to 24.1ºC with mean of 28.1ºC. The relative humidity ranged from 76 to 89 percent with mean of 81 percent. The soil is deep clay, low in available N (196 $kgha^{-1}$), medium in P (22.8 $kgha^{-1}$) and high in available K (274 $kgha^{-1}$) . The first crop (Navarai) was raised during January to April 2013 and second crop (Kuruvai) in June to September 2013. ADT 36 and Co43 were chosen for both the seasons. The experiments were laid out in a split plot design with three replications. M_1 (Farm yard manure +RDF +BF, M_2 (Pressmud @12.5 t ha^{-1} + RDF + BF) and M_3 (control ,inorganic alone) in main plot and foliar application *viz*., S_1 (No spray), S_2 (3% Panchagavya, two times at tillering panicle initiation), S_3 (3% Panchagavya, three times at tillering panicle initiation, flowering), S_4 (3% Dasagavya, two times at tillering panicle initiation),), and S_5 (3% Dasagavya three times at tillering panicle initiation, and flowering) under sub plot were evaluated. The plots were laid out with required specification. Buffer channels were made around each plot so as to serve as irrigation cum drainage channel. Twenty four days old paddy seedlings were planted @ 2 seedlings $hill^{-1}$ with a depth of 3 cm. A spacing of 12.5 × 10 cm was adopted. Care was taken to fill the gap within 10 days after transplanting in order to maintain optimum population in both the seasons.The organic manure used for this study viz., FYM, Pressmud, Panchagavya, and Dasagavya were obtained from Experimental Farm, Department of Agronomy, Annamalai University.The well decomposed matured farmyard manure was collected from dairy farm, Division of Animal Husbandry, Annamalai University and applied to experimental plots as per the treatment schedule .Pressmud was collected from the Sethiathopu M.R.K. Co-operative sugar Mills Ltd. It was dark brown to black in colour. The pressmud was applied @ 12.5 t ha^{-1} and incorporated thoroughly two weeks before sowing. Five hills of rice plants were chosen at random from each net plot area and tagged for recording biometric observations at various crop growth stages. The data on observations and characters studied were statistically analysed by adopting the procedure of Panse and Sukhatme (1978) and for the results that were significant, the critical differences were calculated at 5 per cent probability level to draw statistical conclusion.

Growth attributes

Results of the field experiments revealed that pressmud @12.5t/ha^{-1} + RDF+BF exhibited a salutary effect which was evident in terms of growth of rice *viz.*, plant height, number of tillers, DMP.This might be due to the fact that young seedlings in this treatment had higher vigour, more root growth and less transplant shock during the initial growth stages which stimulated plant height. Similar findings were reported by Virdia and Metha, 2010.

The reason attributed might be that the combination enhanced the rice growth and plants had more open architecture, with tillers spread out more widely, covering more ground area and more erect leaves that avoided mutual shading of leaves..In respect of this organic nutrient and foliar of panchakavya and dasagavya application treatments, the experiment revealed that no spray had distinctly less in the growth components of rice. Among the different foliar application 3 sprayings of dasagavya 3% (S_5) exhibited accelerated effect on growth components because it contained nutrients that are readily taken up by the plants such as nitrates, exchangeable phosphorus and soluble potassium, calcium and magnesium (Selvaraj *et al*., 2006). This might have been responsible for favourable growth parameters particularly, plant height, tiller number, LAI and DMP. Reduced response of rice could be attributed to slow mineralization of organically bound nutrients and presents of lower quantity of nutrients and low population of beneficial microbes as compared to 3 sprayings of dasagavya@ 3%.

Yield components and yield

Among the yield parameters, productive tillers m^{-1} and number of filled grains $panicle^{-1}$ were greatly influenced by rice in respect of the application of pressmud @12.5t/ha^{-1} RDF+BF compared to farm yard manure @12.5 t/ha^{-1} RDF+BF and control plot. Test weight was not influenced by different organic source as it is mainly governed by the genetic characters of the cultivar Senthilkumar *et at*., 2010.The aforesaid increased yield attributes due to 3 sprayings of along with dasagavya @ 3% with basal application pressmud @ 12.5 t ha^{-1} + RDF+BF, might be due to higher nutrient uptake and increased photosynthetic efficiency as evident from optimum LAI values recorded. The constant release of N from organic manure, particularly from no spray supplemented with NPK fertilizer might have satisfied the demand of the rice crop at every phenophase of rice crop. The adequate biomass production, better nutrient uptake and improvement in yield parameters have resulted in higher yield in this plot. The control plot no spray recorded the least value of grain and straw yield Devi and Manimaran (2012). Rice crop with pressmud @12.5t/ha^{-1} RDF+BF registered higher nutrient uptake and was significantly superior to farm yard manure @12.5t/ha^{-1} RDF+BF and control plot sowing methods.The gross return, net return and B:C ratio was higher in pressmud@12.5t/ha^{-1} RDF+BF, along with the application of foliar application dasagavya 3% 3spray (M_2 S_5).This might be due to higher yield of the crop. Sivakumar *et al*., 2014, Mohanasarida and Mathew, 2005. Organic nutrient management *viz.*, basal application of pressmud @ 12.5 t ha^{-1}+RDF +BF, three foliar sprayings of dasagavya 3 spray could be recommended for growing rice growers in Kuruvai season in tail end areas of Cauvery delta regions in Tamil Nadu.

Table 1Number of productive tillers(m^{-2})

	Kuruvai, 2013				Samba, 2013			
Systems	**M_1**	**M_2**	**M_3**	**Mean**	**M_1**	**M_2**	**M_3**	**Mean**
S_1	350.21	367.21	325.21	347.5	336.21	353.21	311.21	333.54
S_2	403.81	422.48	364.95	392.08	384.98	400.95	343.43	376.45
S_3	410.31	428.50	373.34	404.06	391.67	408.96	355.85	385.45
S_4	407.06	425.49	369.16	400.5	388.43	404.96	349.64	38098
S_5	413.56	431.51	377.58	407.5	395.02	413.98	362.05	390.35
Mean	396.99	415.30	362.05		379.2	396.41	344.4	

	Main	Sub	M X S	S X M	Main	Sub	M X S	S X M
SED	8.5	2	4.4	16.1	8	1.6	4.48	15.2
CD (p=0.05)	17	4.0	8.8	32.2	16.0	3.2	9.28	33.6

M_1 – FYM + RDF + BF
M_2 – PM + RDF + BF
M_3 – Control

S_1 – No spray
S_2 – Panchakavya 2 sprays
S_3 – Panchakavya 3 sprays
S_4 – Dasagavya 2 sprays
S_5 – Dasagavya 3 sprays

Table 2. Number of fillled grains panicle^{-1}

	Kuruvai, 2013				Samba, 2013			
Systems	**M_1**	**M_2**	**M_3**	**Mean**	**M_1**	**M_2**	**M_3**	**Mean**
S_1	70.33	83.45	58.98	70.9	71.30	84.42	59.90	71.87
S_2	75.55	96.38	68.91	80.2	76.85	96.90	69.90	81.02
S_3	79.25	98.80	73.81	83.9	80.20	99.76	74.89	85.15
S_4	77.40	97.09	71.86	82.1	78.45	98.07	71.90	82.14
S_5	80.86	101.44	74.76	85.6	81.82	103.4	75.81	87.81
Mean	76.4	95.43	69.6		77.7	96.39	70.81	

	Main	Sub	M X S	S X M	Main	Sub	M X S	S X M
SED	10	1.3	6.5	9.6	10.5	1.8	2.25	9.9
CD (p=0.05)	20	2.6	13.1	19.2	21	3.6	4.51	19.9

M_1 – FYM + RDF + BF
M_2 – PM + RDF + BF
M_3 – Control

S_1 – No spray
S_2 – Panchakavya 2 sprays
S_3 – Panchakavya 3 sprays
S_4 – Dasagavya 2 sprays
S_5 – Dasagavya 3 sprays

Table 3. Grain yield (kg/ha^{-1})

	Kuruvai, 2013				Samba, 2013			
Systems	**M_1**	**M_2**	**M_3**	**Mean**	**M_1**	**M_2**	**M_3**	**Mean**
S_1	2603	3261	2000	2971	3470	4065	2948	3494
S_2	5235	6171	3961	5122	5332	6330	3966	5209
S_3	5578	6521	4296	5465	5708	6732	4383	5607
S_4	5407	6343	4126	5292	5515	6529	4172	5405
S_5	5662	6610	4367	5546	5898	6942	4598	5812
Mean	4897	5781	3750		5184	6119	4013	

	Main	Sub	M X S	S X M	Main	Sub	M X S	S X M
SED	475	80	224	855	500	100	290	950
CD (p=0.05)	950	160	448	1710	1000	1000	560	1900

M_1 – FYM + RDF + BF
M_2 – PM + RDF + BF
M_3 – Control

S_1 – No spray
S_2 – Panchakavya 2 sprays
S_3 – Panchakavya 3 sprays
S_4 – Dasagavya 2 sprays
S_5 – Dasagavya 3 sprays