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Integration of Organics and Mineral N on Growth and Yield of Rice in Typic Ustifluvents Soil

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A B S T R A C T

Field experiments were conducted during Kharif 2007 and 2008 in Typic Ustifluvents soil to study the response of lowland rice to organics and mineral N tested at N equivalence. The treatments consisted of addition of different organics viz., composted coir pith (CCP), green manures (GM), sugarcane trash compost (STC), vermicompost (VC), poultry manure (PM) and FYM applied at 100% N and combination of above organics @50% N and urea@50% N besides 100% N as urea and control. The results revealed that addition of organics or mineral N or both significantly improved growths, yield characters and rice yield over control in both years. The highest grain yield (5067**,** 5050 kg ha^{-1}) and straw yield (6490**,** 6398 kg ha^{-1}) was noticed with vermicompost (50% N) + urea (50% N) which was on par with poultry manure (50% N) + urea (50% N) but superior to rest of the treatments. Growth and rice yield was more with 100% mineral N compared to 100% N with organics alone. Similar influence was noticed with yield attributes. The relative efficiency was in order of IPNS > Fertilizer N > organics. Among organics VC > PM > GM >FYM > STC > CCP.

Introduction

Rice is a staple food for more than 50% of the world population. It occupies an area of 43 million hectares with a production of 84.7 million tonnes in the world (Siddique, 2000). Nitrogen is one of the most important and effective elements required for obtaining high rice yields and stimulating a lot of vital processes in plants in agriculture (Ning, *et al.*, 2009). However, in recent years there has been serious concern about long term adverse effect of continuous and indiscriminate use of inorganic fertilizers on deterioration of soil structure, soil health and environmental pollution (Singh, 2000). Excessive use of fertilizers will cause environmental pollution and will destroy the balance of the ecosystem that is one of the major problems (Zaller, 2007). Organic farming is one of the practices to make the production system more sustainable without adverse effects on the natural resources and the environment (Stockdale *et al.*, 2001; Ram *et al.*, 2011). Organic manures provide regulated supply of plant nutrients by slowly released resulted in increasing yield of rice and nitrogen use efficiency (Sharma, 2002).

However, the use of organic manures alone might not meet the plant requirement due to presence of relatively low levels of nutrients. In order to make the soil well supplied with all the plant nutrients in the readily available form and to maintain good soil health, it is necessary to use organic manures in conjunction with inorganic fertilizers (Fageria, 2001). An integrated nutrient management practices involving the input of green manure,(GM), farm yard manure (FYM) and crop residues are advocated to improve the crop productivity and soil health (Chaudhury *et al.*, 2005).The conjunctive application of organics with inorganic sources of nutrients reduces the dependence on chemical inputs and it not only acts as a source of nutrients but also provides micro nutrients as well as modifies the soil physical behaviour and increases the efficiency of applied nutrients (Parihar *et al.*, 2010). Therefore, it would not be wise to depend only on inherent potentials of soils for higher crop production. More recently, attention is given on the utilization of organic wastes, farm yard manure (FYM), compost, vermicompost and poultry manures as the most effective measure for the improving soil fertility and thereby crop productivity (Hossaen *et al.*, 2011). In keeping the improvement of soil health and enhanced rice productivity in view, field experiments were conducted for 2 years to study the response of rice to organics and mineral N tested of N equivalence.

Materials and Methods

Field experiments were conducted in Padugai series (Typic Ustifluvents) during Kharif, 2007, 2008) to study the response of rice to addition of organics and mineral N tested at N equivalence. The experimental soil was sandy clay loam in texture with pH-6.8, 6.79, EC-0.32, 0.31 dSm^{-1}, OC- 6.09, 6.10 g kg^{-1}, CEC-24.2, 24.0 C mol (p^{+}) kg^{-1}, available N (224.1, 226.2 kg ha^{-1}), P(14.3, 14.1 kg ha^{-1}) and K(314.6, 314.9 kg ha^{-1}) at kharif 2007 and 2008 respectively. The treatment consisted of T_1- Absolute control, T_2-Composted coir pith (CCP- 100% N),T_3-Green manure (GM-100% N),T_4- Sugarcane trash compost(STC-100%N), T_5-Vermicompost (VC-100% N), T_6-Poultry Manure (PM-100%N), T_7- Farmyard Manure (FYM-100%N), T_8- CCP(50% N) + Urea (50% N), T_9- GM(50% N) + Urea (50% N) , T_{10}- STC(50% N) + Urea(50% N), T_{11}-VC (50% N) + Urea (50% N), T_{12}-PM (50% N) + Urea(50%N), T_{13}- FYM(50% N) + Urea (50% N), T_{14}- RDF(120:60:60 N ,P_2O_5 ,K_2O Kg ha^{-1}).The N content in different organics include CCP (1.06%), GM (1.90%), STC(0.45%), VC (1.80%), PM (2.15%) and FYM (0.60%). The treatments T_2 to T_7 received 120 kg N ha^{-1} through various organics only and T_8 to T_{13} received 60 kg N ha^{-1} through various organics (50% N) and 60 kg N ha^{-1} through urea(50%N). Accordingly quantity of organics added varied depending on N content. Biometric observations on plant height, CGR, RGR, NAR, number of grains $panicle^{-1}$, number of panicles m^{-2}, panicle length, and 1000 grain weight were recorded. Grain and straw yields were recorded at harvest. The data was subjected to statistical scrutiny to arrive at meaningful explanation for the effect of treatments on rice crop.

Results and Discussion

Rice growth

Addition of organics or mineral N or their combinations significantly improved the growth and physiological characters of rice over control in both the years (Table 1). Combined application of organic manures and fertilizer N recorded the highest plant height, tiller number, CGR, RGR and NAR

compared to their individual application. Performance of vermicompost followed by poultry manure and green manure applied alone or in combination with mineral N was the best. Vermicompost contains many humic acids which improves the morphological traits of the crop and thus increases the plant height, leaf area index and reduces the period of slow growth (Atarzadeh *et al.*, 2013). Number of tillers hill^{-1} be ranged from 9.30 to 14.96 (tillering stage), 9.91 to 16.01 (panicle initiation) and 7.23 to 12.72 (productive tillers hill^{-1}) during kharif 2007. During kharif 2008, number of tillers hill^{-1} ranged from 9.57 to14.98 (tillering stage), 10.71 to17.23 (panicle initiation) and 8.10 to 13.90 (productive tillers hill^{-1}). The highest tiller count was noticed in vermicompost amended soil plus fertilizer nitrogen (14.96, 14.98) at tillering stage, (16.01, 17.23) at panicle initiation stage and (12.72, 13.90) productive tillers hill^{-1} during kharif 2007 and 2008 respectively. Nayak *et al*., (2007) reported a significant increase in effective tillers/hill due to application of chemical fertilizer with vemicompost. The yield attributes *viz.*, number of panicles m^{-2} and number of filled grains panicle^{-1} were significantly influenced by the integrated nutrient management practice. This might be due to higher concentration of macro and micro nutrients in the vermicompost which was attributed to higher rate of N mineralization as a result of high cation exchange capacity, slow and gradual release of N could make the soil more productive over a longer period, thus enhanced the number of productive tillers m^{-2} (Sathish Kumar *et al*., 2007). The additional benefits from integration of vermicompost and fertilizers occur due to the satisfaction of immediate nutrient requirement from inorganic sources during initial stages of crop growth and from slow releasing of vermicompost at subsequent stages (Roy *et al*., 2001). The highest crop growth rate (14.7, 15.5) gm^{-2}d^{-1} , relative growth rate (37.1,37.5 mg g^{-1} d^{-1}), net assimilation rate (2.87,2.89 gm^{-2}d^{-1}) in kharif 2007 and 2008 respectively was noticed with application of 50%N each through vermicompost and urea (T_{11}) and it was significantly superior to rest of the treatments. Application of vermicompost and chemical fertitilzer caused more cell development which leads to the progressive development of crop growth rate (CGR) and NAR in rice (Shukla and Warsi., 2000). The excellent plant growth in vermicompost application was possibly due to some plant growth promoters in worm casts especially caused significant increase of many growth parameters, like crop growth rate and net assimilation rate (Mishra *et al.*, 2005).

Yield characters

Yield attributing characters like Number of panicles m$^{-2,}$ Number of grains panicle^{-1}, panicle length and thousand grain weight were also significantly improved on addition of organics or fertilizer N or both over control in both the years (Table 2). The highest number of panicles m^{-2} (265.7, 260.5) was noticed in T_{11} (vermicompost 50%N) + urea- N (50%N) and was comparable with T_{12} (poultry manure 50%N + urea –N 50%N) and was significantly superior to rest of the treatments. The best treatment caused (22.8%, 17.3%) increase over control during kharif 2007 and 2008 respectively. Mohandas *et al.*, (2008) observed that the enhanced and continuous supply of nutrients by the enriched organics leading to better tiller production enhanced panicle length and filled grain of rice. The maximum number of grains panicle^{-1} was noticed in rice plants which received combined application of vermicompost (50%N) + urea- N (50%N) (T_{11}) (179.4, 185.9) in kharif 2007 and 2008 respectively and it was comparable with T_{14}(urea – N-

100%N) but to rest of the treatments. Lengthened panicle was observed in T_{11} (vermicompost 50%N) + urea (50%N) – (24.6, 22.1cm) during kharif 2007 and 2008 respectively and was significantly superior to rest of the treatments. The increase in panicle length may be due to application of vermicompost and chemical fertilizers which resulted in more availability of macronutrients as well as micronutrients (Babu *et al.,* 2001). Higher thousand grain weight obtained with combined application of organic and urea than the single application might be result of large amount of carbohydrates and mobile nutrients translocation to the panicle from other organs (Shiralipur *et al.,* 1992).

Rice yield

Data on rice yield (Table 3) showed the effect of mineral N or organics or both at N equivalence were statistically significant.

Increased grain yield of rice over control (4672**,** 5847 kg ha^{-1}) due to 100 % N organics alone ranged from 12.6 to 23.7% and 10.5 to 20.9% in kharif 2007 and 2008 respectively. Corresponding increase in the straw yield was 11.0 to 22.0 and 10.9 to 21.1%. The highest grain yield (5067**,** 5050 kg ha^{-1}) and straw yield (6490**,** 6398 kg ha^{-1}) was noticed with addition of vermicompost (50% N) and urea (50% N)-T_{11} which was on par with poultry manure (50% N) and urea (50% N)- T_{12}. On an average increase in grain yield of rice by best treatment was over 34.2% (control), 23.7% (VC -100% N alone) and 33.8% (100% N- urea). However the rice yield were lower when 100 % N applied through organics alone was compared with 100% mineral N. Higher response to the applied N was expected on this low N status experimental soil.

Table.1 Effect of organics and fertilizer N on the growth characters of rice

Treatments	Kharif 2007					Kharif 2008				
	Plant Height (cm)	Tiller No	CGR gm^2d^{-1}	RGR mg $g^{-1}d^{-1}$	NAR g dm^2 d^{-1}	Plant Height (cm)	Tiller No	CGR gm^2d^{-1}	RGR mg $g^{-1}d^{-1}$	NAR gdm^2 d^{-1}
T_1	74.5	7.23	9.5	24.5	1.35	73.2	8.4	10.4	27.6	1.44
T_2	76.1	8.41	11.2	26.8	2.23	75.5	9.3	12.3	29.4	2.26
T_3	81.7	9.70	12.2	30.4	2.23	79.6	10.9	12.9	30.1	2.37
T_4	76.9	8.91	11.0	29.0	2.12	76.0	9.9	11.7	28.8	2.12
T_5	88.7	10.52	13.0	30.4	2.55	82.8	11.8	13.7	32.2	2.59
T_6	187.0	10.03	12.4	31.3	2.56	81.2	10.7	13.3	31.5	2.56
T_7	79.0	9.51	11.8	30.8	2.44	79.1	10.5	12.4	31.2	2.45
T_8	93.1	10.42	12.0	32.9	2.59	95.8	12.1	13.9	34.5	2.60
T_9	96.1	11.81	13.5	35.6	2.68	97.6	12.8	15.0	36.0	2.72
T_{10}	94.5	11.01	12.5	33.0	2.54	95.5	11.8	13.4	34.1	2.65
T_{11}	98.8	12.72	14.7	37.1	2.87	99.3	14.1	15.5	37.5	2.89
T_{12}	96.5	12.20	13.7	35.6	2.76	98.4	13.2	15.1	36.3	2.87
T_{13}	94.5	11.31	12.9	34.7	2.68	96.4	12.9	14.2	35.4	2.70
T_{14}	97.1	12.12	14.3	35.9	2.80	98.5	12.8	15.3	36.8	2.83
CDat 5%	0.88	0.22	0.23	0.96	0.06	0.70	0.26	0.28	0.58	0.06

Table.2 Effect of organics and fertilizer N on yield attributes of rice

Treatments	Kharif 2007				Kharif 2008			
	No. of panicles m^{-2}	No .of grains $panicle^{-1}$	Panicle Length (cm)	1000 grain weight (g)	No. of panicles m^{-2}	No. of grains $panicle^{-1}$	Panicle length (cm)	1000 grain weight (g)
T_1	216.3	96.9	14.3	15.8	222.1	98.2	14.8	15.3
T_2	221.3	97.4	16.4	16.1	227.2	105.2	16.6	15.7
T_3	221.4	115.4	16.9	16.5	234.8	23.1	17.2	15.8
T_4	220.1	102.4	16.1	16.1	231.2	105.7	16.9	15.6
T_5	232.3	133.4	18.4	16.5	240.1	138.1	19.0	15.9
T_6	228.3	124.1	17.8	16.4	239.8	135.4	18.8	15.8
T_7	230.2	121.3	19.3	16.3	237.4	134.3	7.7	15.7
T_8	254.2	155.8	21.3	16.2	253.5	150.1	19.0	15.8
T_9	256.4	156.4	22.8	16.4	254.8	156.6	21.0	15.9
T_{10}	251.9	153.9	21.9	16.0	251.2	154.8	19.2	15.6
T_{11}	265.7	179.4	24.6	16.3	260.5	185.9	22.1	16.1
T_{12}	262.4	175.3	23.9	16.2	256.4	183.2	21.5	15.7
T_{13}	254.4	166.2	22.6	16.4	253.7	179.2	20.4	15.8
T_{14}	255.5	170.6	23.4	16.2	265.8	181.0	21.8	15.8
CD at 5%	2.64	0.44	0.33	0.11	1.5	0.81	0.17	0.09

Table.3 Effect of organics and fertilizer on rice yield (kg ha-1)

Treatments	Kharif 2007		Kharif 2008	
	Grain yield	Straw yield	Grain yield	Straw yield
T_1	3776	4872	3815	4825
T_2	4253	5412	4215	5353
T_3	4606	5885	4225	5738
T_4	4349	5567	4330	5502
T_5	4672	5956	4615	5847
T_6	4629	5874	4560	5782
T_7	4443	5665	4420	5595
T_8	4717	6015	4635	6130
T_9	5022	6413	5010	6334
T_{10}	4814	6133	4765	6032
T_{11}	5067	6490	5050	6398
T_{12}	5031	6345	5015	6359
T_{13}	4913	6264	4845	6143
T_{14}	5054	6418	4982	6317
CD at 5%	55.9	58.5	21.4	23.3

Fig.1 Linear relationship between grain yields with growth analysis

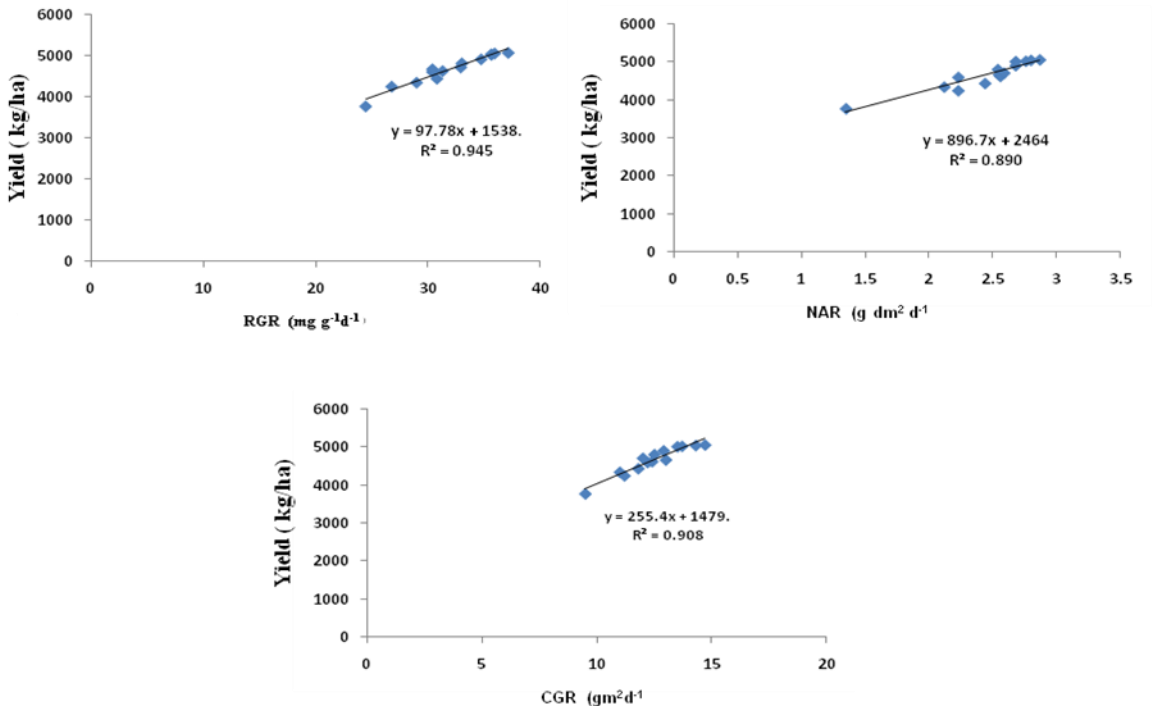
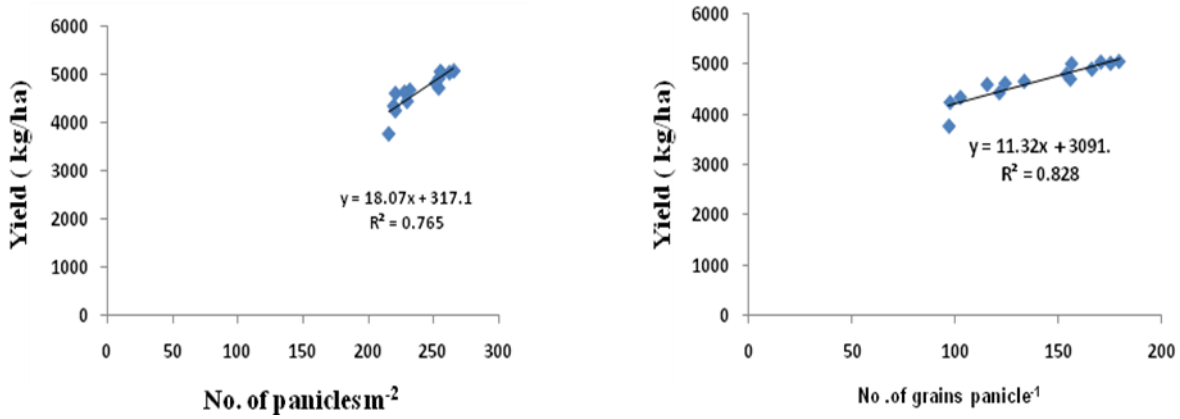


Fig.2 Linear relationship between grain yield with No. of panicles m-2 and No. of grains panicle-1



Application of organic manure in addition to the recommended dose of fertilizers produced significantly higher grain yield in rice (Rabeya Khanam *et al.,* 1997). The effect of manure on increasing the number of grains panicle^{-1} was more pronounced as compared to fertilizers. This might be due to more availability of nutrient from the manure (Rahman *et al.,* 2009) reported that the application of organic manure and chemical fertilizers increased the grain and straw yields of rice. It is clear that organic manure in combination with inorganic fertilizers increased the vegetative growth of plants and thereby increased straw yield of rice. Grains/panicle significantly increased

the grain yield due to the application of vrmicompost and chemical fertilizers (Razzaque, 1996).These results are also in agreement with (Haque, 1999). This could be due to high availability and utilization of nitrogen by the crop from inorganic source (fertilizer) whereas release of nitrogen from organic source may not be full during the crop growth period. These findings are in conformity with (Singh *et al.,* 2005) and (Pandey *et al.,* 2007) (Bhattacharjee, *et al.,* 2001) reported that the increased yield was due to uptake of nutrients in paddy and the application of vermicompost reduced the dosage of NPK. This may indicate that vermicompost reduces the loss of nutrients through leaching from the soil. The yield increased with judicious use of organic and inorganic fertilizers, which enabled rice plant to assimilate sufficient photosynthesis resulting in increased LAI, dry matter production and these together produced more productive tillers, panicle and number of filled grains leading to higher grain yield (Mondal *et al.,* 2003).

In conclusion, the relative efficiency was in order of IPNS > Fertilizer N > organics. Among organics VC > PM > GM >FYM > STC > CCP. This study showed that organics and fertilizer N improved the growth parameters and yield attributes thereby improved the grain and straw yield than organics alone or fertilizer alone. The use of organics can improve the effect of applied fertilizers and also can save up to 25% of mineral fertilizers.

References

Atarzadeh, S.H.,. Mojaddam M. and Saki Nejad, T. 2013. The interactive effects of humic acid application and several of nitrogen fertilizer on remobilization star wheat. *Int. J. Biosci.,* 3(8): 116-123.

Babu, S., Marimuthu, R., Manivanna, V. and Kumar, S.R. 2001.Effect of organic and inorganic manures on growth and yield of rice. *Agri. Sci. Dig.,* 21: 232-34.

Bhattacharjee, G., Chaudhuri, P.S., and Datta, M. 2001. Response of paddy (var. TRC-87-251) crop on amendment of the field with different levels of vermicompost. *Asian J. Microbiol. Biotechnol. Environ. Sci.,* 3: 191-196.

Chaudhury, J., Mandal, U.K., Sharma, K.L., Ghosh, H. and Mandal, B. 2005. Assessing Soil quality under long term rice based cropping system. Communications in Soil Sci. *Plant Anal.*, 36: 1141-1161

Fageria, N. K., and Barbosa Filho. M.P. 2001. Nitrogen use efficiency in lowland rice genotypes. *Communications in soil science and plant analysis*, 32: 2079-2089.

Haque, M. Q., Rahman, M. H., Fokrul, I., Jan, Rijmpa, and Kadir, M. M. 2001. Integrated nutrient management in relation of soil fertility and yield sustainability under Wheat- Mung-T. aman cropping pattern. *On Line J. Biol. Sci.,* 1(8): 731-734.

Hossaen, M.A., Shamsuddoha., A.T.M., Paul, A .K., Bhuiyan, M. S. I. and Zaheer. 2011. Efficacy of different organic manures and inorganic fertilizer on the yield and yield attributes of Boro rice. *The Agriculturists J.,* 9(1&2): 117-125.

Jagadish Kumar, and Yadav. M.P. 2008. Effect of integrated nutrient management on growth, yield attributes, yield and economics of hybrid rice (Oryza sativa L.). *Res. Crops,* Vol. 9(1), pp. 10-13.

Mishra, M.S., Rajani, K., Sahu-Sanjat, K., and Padhy Rabindra, N. 2005. Effect of vermicomposted municipal solid

wastes on growth, yield and heavy metal contents of rice (Oryza sativa). *Fresenius Environ. Bull.,* 14: 584-590.

Mohandas, S. and Appavu, K. 2000. Direct and residual effect of combined application of basic slag with green leaf manures on soil available nutrients and yield of rice. *Madras Agric. J.*, 87(1-3): 53-56.

Mondal, S.S., Sarkar, S., Gosh, A., and Das, J. 2003. Response of summer rice (Oryza sativa) to different organic and inorganic sources of nutrients. *Crop Res.,* Vol. 25, pp. 219-222, .

Niang, H.F., Liu, Z.H., Wang, Q.S., Lin, Z.M., Chen, S.J., Li, G.H., Wang, S.H. and Ding, Y.F. 2009. Effect of nitrogen fertilizer application on grain phytic acid and protein concentrations in japonica rice and its variations with genotypes. *J. cereal Sci.*, 50(1): 49-55.

Pandey, N., Verma, A.K., Anurag and Tripathi, R.S. 2007. Effect of integrated nutrient management in transplanted hybrid rice (Oryza sativa). *Indian J. Agron.*, 52(1): 40-42.

Parihar, C.M., Rana, K.S., and Kantwa, S.R., 2010. Nutrient management in pearl millet (Pennisetum glaucum)-mustard (Brassica juncea) cropping system as affected by land configuration under limited irrigation. Indian J. Agron. 55:191-196.

Rabeya Khanam, Sahu, S. K., and Mitra, G.N (1997). Yield maximization of rice through integrated Nutrient management on Aeric Ustochrept. *J. Indian Society of Soil Sci.,* 45(2): 96-397.

Rahman, F., Sakhawat Hossain, A.T.M., Saha P.K. and Mazid Miah, M.A.2009. Effect of integrated use of organic manures and chemical fertilizers on yield, nutrient uptake and nutrient balance in the bush bean-T.AUS –T. Aman cropping pattern. *Bangladesh J. Agril. Res.*, 34(1):157-164.

Ram, Moola, Davari, Mohammadreza and Sharma, S.N. 2011. Organic farming of rice (Oryza sativa L.) - wheat (Triticum aestivum L.) cropping system: a review. *Int. J. Agronomy and Plant Production,* 2(3): 114-134.

Razzaque, M.M.A. 1996. Comparative study on the effect of rice straw, farmyard manure and fertilizer nitrogen on the growth and yields of BR 11 rice. M.S. Thesis, Dept. Soil Sci (January-June, 1996, Sem.), BAU, Mymensingh.

Roy, H.K., Ajay kumar, Sarkar Prasad, A. K., Sharma, R.C., and Trehan, S.P 2001. Integrated nutrient management by using farm yard manure and fertilizers in potato-sunflower-paddy rice rotation in the Punjab. *J. Agr. Sci.,* 137(3): 271-278.

Sahaa, P.K., Ishaqueb, M., Salequeb, M. A., Miahb, M. A. M., Panaullahb, G.M., and Bhuiyanb, N.I. 2007. Long-term integrated nutrient management for rice based cropping pattern: effect on growth, yield, nutrient uptake, nutrient balance sheet, and soil fertility. Communication in soil science and plant analysis, Vol. 38(5-6), pp. 579-610. http://dx.doi.org/10.1080/00103620701215718 .

Sathesh Kumar, T., Natarajan, S., and. Arivazhagan, K. 2007. Effect of integrated NPK management on the productivity of rice-rice cropping sequence under Cauvery delta region. *Oryza*, Vol. 44(2), pp. 177-180,.

Senthil Kumar, R., and Panneerselvam, A. 2012. Studies on the effect of different native stains of Azospirillium on paddy (Oryza sativa L.). *J. Microbial. Biotech. Res.,* Vol. 2(6), pp. 88-89,.

Sharma, S.P., Subehia, S.K., and Sharma, P.K. 2002. Long term effects of chemical fertilizers on soil quality, crop productivity and sustainability. Research Bulletin CSK Himachal Pradesh Krishi Vishva vidyalaya, Palampur.

Shiralipur, A., McConnel, D.B., Smith, W.H. 1992. Uses and benefits of MSW compost: a review and assessment. *Biomass Bioenergy*, 3: 267-279.

Shukla, S.K. and Warsi, A.S. 2000. Effect of sulfur and micronutrients on growth, nutrient content and yield of rice. Ind. *J. Agric. Res.*, 34 pp. 203-205.

Siddiq, E.A. 2000. Rice-yawning productivity gaps. The Hindu survey of Indian Agriculture, pp.39-44.

Singh, R.B. 2000. Environmental consequences of agricultural development : a case study for the green revolution state of Haryana, India.*Agr. Ecosys. Environ.*, 82: 97-103.

Singh. 2005. Integrated management of Azolla and Vermicompost on yield and nutrient uptake by rice and soil fertility, *J. Indian Soc. Soil Sci.*, 53 (1) 107-110.

Stockdale, E.A., Lampkin, N.H., Hovi, M., Keatinge Lennartssen, R., Mac Donald, E.K.M., Tattersall, S., Woffe, F.H., and Watson, C.A. 2001. Agronomic and environmental implications of organic farming systems. *Adv. Agronomy*, 70: 261-327.

Virdia, H.M., Mehta, H.D., Parmar, V.N., Batna, A.M., Patel, Z.N., and Gami, R.C. 2010. Integrated nutrient management in transplanted rice (Oryza sativa). *Green Far.*, Vol. 1(3), pp. 249 – 252.

Zaller, J.G. 2007. Vermicompost as a substitute for peat in potting media Effects on germination, biomass allocation, yields and fruit quality of three tomato varieties. *Scientica Horti*, 112: 191-199.

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