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Organic Farming on Productivity of Rice and Soil Fertility under Alfisols of Southern Transition Zone of Karnataka, India

GANAPATHI[1], VISHWANATH SHETTY Y.[2], PRADEEP S.[3], CHIDANANDAPPA, H.M.[4,] NOOR NAWAJ[5], AND DHANANJAYA, B.C.[6]

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Abstract

A field experiment was conducted during kharif 2012-13 on effect of organic farming on productivity of Rice and soil fertility under alfisol at organic farming research centre, ZAHRS, UAHS, Shimoga, Karnataka, India. Organic biomass generation is primary importance in organic production system to achieving the higher yield and fertility. The results of the study revealed that FYM applied for raising of green manures as in-situ recorded significantly higher green biomass yield. The 100 per cent recommended N(100 kg N/ha) equivalent to FYM applied at sowing of Sesbania aculeata green manure recorded 20.60 ton /ha green biomass yield followed by 100 per cent recommended N equivalent to FYM applied to soil at sowing of mixed green manures (Sesbania aculeata + Crotolaria juncea + Vigna unguilculata) recorded 16.26 ton/ha. Maximum grain (44.05 q/ha) and straw yield (82.01 kg/ha) of paddy as well as soil organic carbon, available N, P_2O_5, K_2O, S and soil microorganisms were recorded in 100 per cent N through FYM applied at sowing of Sesbania aculeata + FYM @10 t/ha at in-situ incorporation of raised green manure biomass followed by 100 per cent N through FYM applied at sowing of mixed green manures + FYM (@10 ton/ha) applied at incorporation. Higher yield and soil fertility under organic paddy production system was achieved through the application of organic manure for raising (at sowing) of green manures as in-situ as well as at incorporation of in-situ raised green manures.

Introduction

Rice (*Oryza sativa* L.) is one of the important food grain crops produced and stable food for more than two billion people in Asia and one billion people of Africa and Latin America. The declined soil fertility and productivity of majority crops in India mainly due to indiscriminate use of agrochemicals and fertilizers. The indiscriminate use not only affecting the soil and cop but also affecting the environment and health of living beings. The wide spread soil nutrient deficiencies, contaminated food and fodder are the negative impact of chemical agriculture on environment and human health has been reported and documented. In rice production system major part of agro chemicals used, to control pests and diseases and more than 50 percent of fertilizers applied to increase the production were contaminated the natural resources. Increased environmental awareness and health consciousness among the producers and consumers apart from fetching good return worldwide to think about organic agriculture as an alternate way for sustainable agriculture to protect the environment and lives health. Organic farming is one of the practices to make rice based cropping system more sustainable without adverse effects on the natural resources and the environment (Stockdale et al. 2002). In organic rice production system nutrients supply through different organic sources is prime importance. Among the organic source the nutrient through green manuring is widely acceptable and feasible technology, but higher green biomass production is difficult without addition of nutrients. The green manure biomass production is through the supply of organic sources of nutrients at the time of sowing to raise green manure crop as the in-situe and incorporate into the soil for achieving the sustainable maximum production. Therefore a study under taken to increase the green manure bimass grown as insitue and incorporate into the soil with additional quantity organic manure to enhance the rice yield and soil fertility under organic system.

[1] Organic Farming Research Centre, ZAHRS, UAHS, Shimoga, Karnataka, India
[2] ZAHRS, UAHS, Shimoga, Karnataka, India.
[3] Organic Farming Research Centre, ZAHRS, UAHS, Shimoga, Karnataka, India
[4] Department of Soil Science and Agricultural Chemistry, College of Agriculture, UAHS, Shimoga, Karnataka, India.
[5] Organic Farming Research Centre, ZAHRS, UAHS, Shimoga, Karnataka, India
[6] Department of Soil Science and Agricultural Chemistry, College of Agriculture, UAHS, Shimoga, Karnataka, India.
eMail: ganapathiguddekoppa@yahoo.com

Material and methods

A field experiment was conducted during *Kharif* 2012-13 at organic farming research centre, University of Agricultural and Horticultural Sciences, Navile, Shimoga, Karnataka, India. The soil of experimental site (Initial values) was shallow depth, well drained, sandy loam in texture, low organic carbon (0.50%), low soil available P_2O_5 (15 kg/ha), medium available K_2O (135 kg/ha), low available N (< 280 kg/ha), low CEC (7.3 cmol p^+kg^{-1}), Zn (1-1.1 ppm), Mn (10-15.6 ppm), Fe (15-18.5 ppm) and Cu (1-1.25 ppm). The soil pH was 6.5 and electrical conductivity of soil was 0.45 $dS^{-1}m$. The experiment was laid out in RCBD design with three replication and eight treatments as given in table 1. The quantity of manure was applied on N equivalent basis (FYM:1.02% and neem cake : 5.6 %) as per treatments. Incorporation of green manure was done by ploughing after 8 weeks and allowed it for 15 days to facilitate decomposition then three week old paddy variety jyothi seedlings were transplanted manually with a spacing of 22.5 x 10cm @ 3 seedlings per hill in 24 m^2 area plot. One spray of econeem 50000 ppm @ 4ml per litre (65 DAT), one spray of cow urine and water (1:10) ratio (35 DAT) and two (30 DAT & 55 DAT) spray of panchagavya @ 3 percent were taken as a measure of managing pest, disease and enhance the plant growth. Representative surface soil samples were collected before initiating and after harvest of the paddy crop using core sampler. The air dried processed soil samples were used for analysis. The standard methods and procedure adopted by Piper (1966) and Jackson (1973) were used for the soil analysis. Grain and straw yield were recorded. Statistical analysis of the data was done using computer aided MSTAT.

Results

FYM @10 ton/ha applied at sowing of green manures recorded significantly higher green biomass yield as compared to without FYM. The plot receiving 100 percent N equivalent to FYM at sowing of Dhaincha recorded maximum green biomass yield (20.60 ton/ha) followed by mixed green manures (Dhaincha + Sunhemp + Cowpea) crops (16.26 ton/ha) Maximum grain (44.05 q/ha) and straw yield (82.01 q/ha) , soil available nutrients and microbial population were recorded in the treatment receiving 100 % N equivalent to FYM at sowing of Dhaincha + FYM @10 t/ha at incorporation followed by 100 % N equivalent to FYM at sowing of mixed green manures + FYM @10 ton/ha at incorporation (38.43 q/ha grain and 71.68 q/ha straw yield, respectively) (Table1).

Table 1: Green biomass yield, Rice Productivity, Microbial population and soil properties as affected by organic farming practices

Treatments		Green biomass yield (t/ha)	Grain	Straw	Microbial population ($cfug^{-1}$)					pH	EC	OC	N	P_2O_5	K_2O	S
			Yield (Kg/ha)		B	F	A	PS	NF	1:2.5	dSm^{-1}	g/kg	Kg/ha			ppm
T_1	Without FYM at sowing of Dhaincha (Insitu) green manure + RDM (FYM@10 ton/ha) at incorporation	3.86	26.43	48.06	71	14	10	25	34	6.4	0.49	4.8	168.9	17.1	144.2	16.3
T_2	Without FYM at sowing of mixed green manures (Insitue) + RDM (FYM,10 ton/ha) at incorporation of green manure	2.96	22.73	43.12	52	13	08	21	30	6.8	0.58	4.4	158.4	17.2	146.0	15.1
T_3	T_1+ 50 % rec N through neem cake at incorporation	3.56	26.80	47.87	73	13	10	27	36	6.5	0.55	4.3	164.6	18.1	167.2	19.0
T_4	T_2 + 50 % rec N through neem cake at incorporation	3.11	23.25	43.25	64	12	08	23	33	6.3	0.51	4.1	162.3	18.3	155.9	20.3
T_5	100 % rec N through FYM at sowing of dhaincha green manure + RDM (FYM @ 10 t/ha)at incorporation	20.60	44.05	82.01	126	22	18	36	49	6.6	0.65	6.7	196.4	24.77	185.4	26.5
T_6	100 % rec N through FYM at sowing of mixed green manure + RDM (FYM @10 t/ha) at incorporation	16.26	38.48	79.68	112	20	13	32	45	6.4	0.70	5.9	187.4	22.29	179.5	24.4
T_7	50 % rec N through FYM at sowing of dhaincha green manure + 50 % rec N through (FYM + neem cake) at incorporation	9.29	36.43	71.40	97	18	10	26	35	6.5	0.56	4.8	170.2	20.4	166.7	21.3
T_8	50 % rec N through FYM at sowing of mixed green manure + 50 % rec N through (FYM +neem cake) at incorporation	8.36	34.54	69.04	86	15	10	27	32	6.3	0.59	5.0	169.6	20.17	170.3	20.6
SEm+		**0.886**	**1.97**	**4.21**	**-**	**-**	**-**	**-**	**-**	**0.12**	**0.071**	**0.06**	**5.04**	**1.01**	**9.88**	**1.07**
CD@5%		**2.551**	**5.64**	**12.02**	**-**	**-**	**-**	**-**	**-**	**0.37**	**0.210**	**0.11**	**14.6**	**3.23**	**28.99**	**3.14**
CV (%)		**17.73**	**11.82**	**12.05**	**-**	**-**	**-**	**-**	**-**	**1.12**	**7.27**	**1.79**	**1.68**	**3.21**	**3.48**	**3.05**

B – Bactria (10^5), F – Fungi (10^4), A – Actinomyctes (10^3), PS - Phosphorous solubilisers (10^3), NF - Nitrogen Fixers (10^3), OC - organic carbon
DAT: Days after Transplanting

Discussion

Natarajan (2003) reported that *Sesbania aculeata* with poultry manure resulted in higher rice yield than combination with press mud and FYM. Kenchaiah (1997) reported that application of *Sesbania rostrata* + poultry manure and FYM increased the grain and straw yield of rice. Application of green manures increased yield and yield components reported by Sudhakar (2000) Significantly higher organic carbon (6.7 g/kg), available N (196.4 kg/ha), available P_2O_5 (24.77 kg/ha), available K_2O (185.4 kg/ha) and available S (26.51 ppm) were recorded in the treatment receiving 100 percent N equivalent to FYM at sowing of dhaincha + FYM @10t/ha at insitu incorporation followed by the treatment receiving 100 percent N equivalent to FYM at sowing of mixed green manures + FYM @10 ton/ha at incorporation. The continuous application of all the organic sources to rice for three years significantly improved the soil organic carbon, N, P and K status at the end of the cropping system (Singh 2011). The higher soil nutrients and microbial properties in organically managed farms compared to chemical farms (Moola Ram *et al* 2011). The slightly increase in soil pH and electrical conductivity might be due to release of soluble salts during decomposition of green manures and FYM.

Conclusion

The research results can be concluded that the insitue green manuring with addition of organic manures increased the green manures biomass yield. In situe Green manuring with FYM at sowing and at incorporation enhanced the productivity of organically grown rice and soil fertility.

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