Annals of Plant and Soil Research 21(4): 404-406 (2019)
Short Communication

Effect of organic farming practices on yield, nutrient uptake and soil fertility in rice-rice cropping system in Godavari Delta

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Received: July, 2019; Revised accepted: September, 2019

Organic farming aims for human welfare without harming the environment and follows the principles of health, ecology, fairness and care for all including soil. The modern concept of organic farming combines the tradition, innovation and science. With the increasing awareness about the safety and quality of foods, long term sustainability of the system and accumulating evidences of being equally productive, the organic farming has emerged as an alternative system of farming which not only addresses the quality and sustainability concerns, but also ensures a profitable livelihood option. Cultivated area under certified organic farming has grown almost 17 fold in last one decade (42,000 ha in 2003-04 to 7.23 lakh ha in 2013-14).Rice is the major crop that receives maximum quantity of fertilizers (40%) and pesticides (17-18%). Increased/indiscriminate use of chemical fertilizers and pesticides during green revolution period resulted in several harmful effects on soil, water and air causing their pollution. This has reduced the productivity of the soil by deteriorating soil health in terms of soil fertility and biological activity. The excess/indiscriminate use of pesticides has led to the entry of harmful compounds into food chain, death of natural enemies and development of resurgence/resistance to pesticides.

A field experiment was laid out during *kharif* and *Rabi*, 2013-14 at Regional Agricultural Research Station, Maruteru. Initial soil had pH-6.2; E.C-0.91 dS m^{-1}; organic carbon 11.6 g kg^{-1}; available nitrogen 276 kg ha^{-1}; available phosphorus 20.4 kg ha^{-1} and available potassium 278 kg ha^{-1}. Only organic manures/crop residues/green manures were utilized to supply plant nutrients based on soil test recommendations of the location. FYM @ 10 tons ha^{-1} along with insitu grown dhaincha green manure were incorporated. Bio-fertilizers Azospirillum @ 2-3 kg culture/ha was mixed with 25 kg FYM applied to the soil just before planting and 500kg neem cake ha^{-1} was applied in two splits at tillering and panicle initiation stage. Under inorganic farming recommended dose of fertilizers were applied along with the spraying of zinc sulphate @ 2g lt^{-1}, when ever zinc deficiency was observed on the standing crop. Crop was sown in the month of July and transplanted in the month of August,2013 for kharif season and for rabi season crop was sown in the month of December,2013 and transplanted in January,2014. Soil samples were collected before planting and after harvest of the crop for analysis. Grain and straw yields were collected at the time of harvest of the crop. Nutrient content in both grain and straw were determined following standard procedures (Jackson, 1973).The grain yield was higher with organic farming (5.06 t ha^{-1}) than conventional farming of rice (4.81 t ha^{-1}) during kharif. However, during rabi, conventional farming recorded higher yield of 6.86 t ha^{-1} than organic farming 5.93 t ha^{-1}. Yields of rice was found satisfactory with organic farming during kharif season. This could be due to mismatch of nutrient release from organic sources and crop demand as influenced by seasonal conditions in the initial years, and once the soil fertility was built up sufficiently, organic system also produced equal yields as conventional system.

Thus, slow and gradual release of nutrients from organics during the initial years of conversion to organic farming could not result in increased yields. But, repeated application of organics over the years may build up sufficient soil fertility by improving soil biological activity. A 20-30% less yield of crops in organic farming was reported by Yadav and Bihari (2006) and Tripathi *et al.* (2019). The recession in the crop yields during initial phase of transition from conventional to organic agriculture and recovery in yields after 2-3 years was reported by Maeder *et al.,* 2002.

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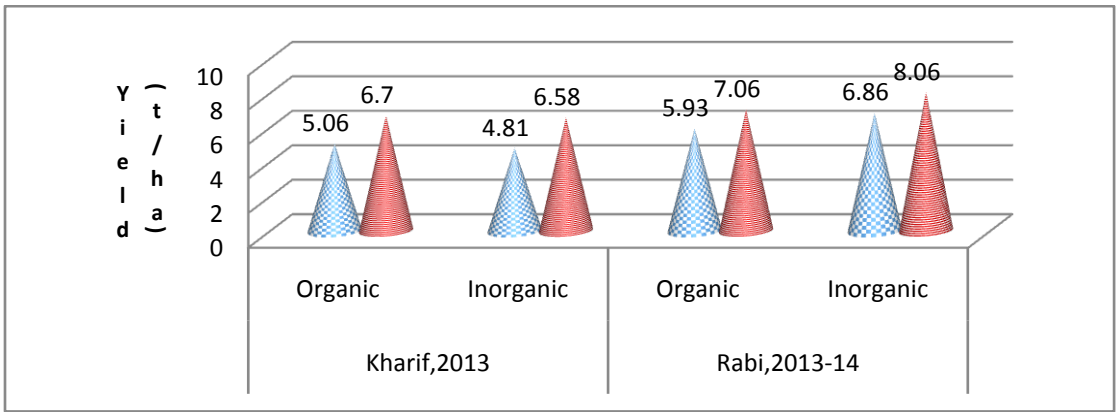

Fig. 1: Grain and straw yield (t ha^{-1}) of rice under organic and conventional farming systems

Table: 1 Effect of organic farming practices on nutrient content (%) and uptake (kg ha^{-1}) of rice grain and straw

	Nitrogen	Phosphorus	Potassium	Nitrogen	Phosphorus	Potassium
	Nutrient Content (%)			Nutrient Uptake (kg ha^{-1})		
Organic farming			Kharif,13			
Grain	0.92	0.23	0.42	44.16	11.04	20.16
Straw	0.72	0.12	1.23	46.08	7.30	78.72
Inorganic farming		Nutrient Content (%)			Nutrient Uptake (kg ha^{-1})	
Grain	1.02	0.23	0.44	51.61	11.64	22.26
Straw	0.71	0.09	1.27	47.71	5.91	85.34
			Rabi,13-14			
Organic farming		Nutrient Content (%)			Nutrient Uptake (kg ha^{-1})	
Grain	1.09	0.27	0.44	55.15	13.66	22.26
Straw	0.66	0.14	1.11	44.22	9.38	74.37
Inorganic farming		Nutrient Content (%)			Nutrient Uptake (kg ha^{-1})	
Grain	1.01	0.22	0.49	48.58	10.58	23.57
Straw	0.69	0.21	1.14	45.40	13.82	75.01

Nutrient content of rice grain and straw was not varied between the organic and inorganic farming systems. However, as the grain and straw yields were found to be high in inorganic system of farming nutrient uptake was found to be more in inorganic farming system, than the organic farming. Similar trend was observed in both kharif and rabi seasons (Tripathi *et al.* 2019).

Table 2: Effect of organic farming practices on soil properties

Soil Properties	Kharif,2013		Rabi,2013-14	
	Inorganic	Organic	Inorganic	Organic
pH	5.69	5.73	5.86	6.17
E.C (dS m^{-1})	0.68	0.58	0.68	0.61
O.C (g kg^{-1})	11.8	12.8	11.3	12.1
Avail .N (kg ha^{-1})	175.8	121.9	156.8	125.4
Avail.P_2O_5(kg ha^{-1})	40.8	39.4	55.2	74.3
Avail.K_2O(kg ha^{-1})	219.0	187.0	285.6	260.2

Organic carbon content of the soil increased from 11.8 to 12.8 g kg^{-1} under organic farming, while under inorganic farming it increased marginally (11.3 to 12.1 g kg^{-1}). Soil available nutrient status was marginally higher under organic farming compared with inorganic

farming. A further reason for the SOC increase may be the slow decomposition of applied and native soil organic matter due to prevailing anoxic conditions and formation of difficultly decomposable SOC under rice-rice system. Comparable increases in organic carbon, available N, P and K through addition of organic materials was also reported by Surekha *et al.*, (2013) and Yadvinder-Singh *et al.* (2004). Organic farming enhanced soil organic carbon, available phosphorus content and microbial population / enzymatic activity of soil thus making it sustainable for organic crop production.

Yields of rice were found satisfactory with organic farming during *kharif* season. However application of 10t FYM ha^{-1}, vermicompost and 500 kg Neem cake ha^{-1} in two splits was insufficient to meet the nutrient requirement of rice crop during *rabi* season. Soil nutrient status improved in organic plots compared with inorganic plots.

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