International Journal of Chemistry Studies
ISSN: 2581-348X; Impact Factor: RJIF 5.44
Received: 05-04-2019; Accepted: 09-05-2019
www.chemistryjournal.in
Volume 3; Issue 4; July 2019; Page No. 13-16

Comparative study on organic and conventional farming in rice under low land ecosystem of Godavari delta, Andhra Pradesh

A Sireesha[1], CH Sreenivas[2], T Usharani[3], PV Satyanarayana[4]
[1] Senior Scientist (Soil Science), Regional Agricultural Research Station, Anakapalle, Visakhapatnam, Andhra Pradesh
[2-4] Regional Agricultural Research Station, Maruteru, West Godavari dt, Andhra Pradesh, India

Abstract
A field experiment was laid out during *Kharif*, 2015 and 2016 with a rice variety MTU-7029 (Swarna) at Regional Agricultural Research Station, Maruteru. The grain yield obtained with organic farming was 5817 kg/ha during *Kharif*,2015 and 5506 kg/ha during *Kharif*,2016. While, under conventional farming of rice, which recorded grain yield of 5150 kg/ha during *Kharif*,2015 and during *Kharif*,2016 conventional farming recorded grain yield of 5762 kg/ha. Hence, found that, there was a stable increase in grain yields of rice under organic farming in comparison to conventional farming during 2015 and during 2016 it was found at par. Soil analysis data resulted that Organic carbon content of the soil was increased from 1.16 % to 1.32% under organic farming, while under inorganic farming it was increased marginally (1.16 to 1.21). Soil available nutrient status was marginally higher under organic farming compared with inorganic farming. Nutrient uptake of nitrogen, phosphorus and potassium were also found to be high with organic farming than conventional farming, slight increase was observed during *Kharif*, 2016 under conventional farming. Total bacterial, fungal and actinomycetes population were found to increase under organic farming. Yields of rice was found satisfactory with organic farming during *Kharif* season. Soil nutrient status were found superior in organic plots compared with inorganic plots.

Keywords: organic farming, conventional farming, rice, soil properties, grain and straw yield

Introduction
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. Although, history states that the movement for organic way of life recognized in 1905, it could gain ground after realizing the ill effects of modern agriculture in the late 1990's. Rice is the major crop that receives maximum quantity of fertilizers (40%) and pesticides (17-18%). Declining trend in productivity observed in several long-term experiments all over India. 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.
Organic farmers build healthy soils by nourishing the living component of the soil, the microbial inhabitants that release, transform, and transfer nutrients. Soil organic matter attributes to good soil structure and water-holding capacity. Organic farmers feed soil biota and build soil structure and water-holding capacity. Organic farmers build soil organic matter with cover crops, compost, and biologically based soil amendments. Development of organic farming package for cereal crop like rice is very much needed. As the yield levels in organic agriculture will be less, suitable varieties that responds to organic culture, cost effective and eco friendly technologies need to be identified for sustainable production. Hence this project was proposed to develop organic farming package in rice keeping in view of various organic certification standards.
According to local sources, the organic food market is growing rapidly in Indian cities mainly due to health benefits. According to trade estimates, the Indian organic food industry is likely to grow to around $1.7 billion by 2017, up about 900% from around $190 million in 2011. Rice is the second largest crop (after cotton) under organic farming in India. Demand for organic rice is growing in most parts of India and exporters are increasingly adding organic rice to their product range.

Materials and Methods
A field experiment was laid out during *Kharif*, 2015 and 2016 with a rice variety MTU-7029 (Swarna) at Regional Agricultural Research Station, Maruteru.

Organic farming
a. Nursery: In seed bed preparation, organic manures such as FYM, compost, vermi-compost were used and Seedling root dipping was done in azospirillum and PSB suspension prepared with 600 g of culture for seedlings sufficient to transplant in a hectare of land.
b. Main field: Only organic manures/crop residues/green manures were utilized to supply plant nutrients based on soil test recommendations of the location. Nutrient concentrations and moisture content of organic manures, their contribution to plant uptake and crop nutrient requirement were considered to estimate the quantity of organic sources. 30 days before starting of season,

Diancha green manure crop was sown and incorporated at the time of first plough. During puddling 10 tons of Farm Yard Manure was applied and incorporated. After transplanting azospirillum @ 500 ml/acre and PSB @ 500 ml/ acre biofertilizers were mixed with 25 kg of FYM and kept overnight and applied to the main field.

At the time of tillering and panicle initiation stage vermicompost was applied in two splits @ 200 kg/acre under organic farming treatment.
Weed management: Only hand weeding or mechanical weeding is to be done.
Pest management: Pest management was done only through botanicles like neemoil during active growth period of the crop for two to three times and spraying of cow urine was also done to control diseases. Pheramone traps were also erected to manage pests.

Conventional Farming
Nursery: Fertilizers were applied as 1 kg Phosphorus as basal and 1kg nitrogen, 1kg potash containing fertilizers in two splits as basal and after 12-15 days after germination of seeds. Need based chemical management of pests were also done during nursery period.
Main field: Recommended Dose of Fertilizers (90-60-60 kg N-P-K) was applied. The entire dose of single super phosphate (P source) was applied before transplanting, Nitrogen through urea was applied in three splits (Basal, Tillering and PI stage) and Muriate of potash (K source) was applied in two splits as basal and PI stage. Under inorganic farming application of recommended dose of fertilizers was done along with the spraying of zinc sulphate @ 2g/lit, when ever zinc deficiency was observed on the standing crop. Timely plant protection measures were taken for control of pests and diseases.
Initial soil samples were collected for analysis and Initial soil characteristics were analyzed before planting. Soil pH-6.2; E.C 0.91 Ds/m; Organic carbon content 1.16%; Available Nitrogen 276 kg/ha; Available Phosphorus 20.4 kg/ha and Available Potassium 278 kg/ha.
Data on tillers/ m^2 was collected at maximum tillering stage and data on productive tillers/ m^2 was collected at grain hardening stage. Yield parameters and yield data was collected at the time of harvesting. Nutrient content in both grain and straw were worked out following standard procedures and respective uptakes were calculated using grain and straw yield. Post harvest soil samples were collected for physic- chemical, chemical, biological analysis under both organic and conventional systems.

Results and Discussion
The average grain yield obtained under organic farming was 5662 kg/ha and under conventional farming it was 5456 kg/ha. Hence, found that, there was a stable increase in grain yields of rice under organic farming in comparison to conventional farming. During *Kharif*, 2015 grain yield obtained with organic farming was 5817 kg/ha and 5506 kg/ha during *Kharif*, 2016. While, under conventional farming of rice, which recorded grain yield of 5150 kg/ha during *Kharif*,2015 and during *Kharif*, 2016 conventional farming recorded grain yield of 5762 kg/ha. Although grain yield under organic farming is often lower than under conventional farming, in some cases, increased yields of rice were also reported (Chitra and Janaki 1999) [2]. 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. Tanaki *et al*. (2002) [12] also reported that the growth and yield of rice with organic farming in comparison with conventional farming in Japan and found that the growth and yield of rice increased with continuous organic farming.

Table 1: Effect of Organic farming on yield attributes, grain and straw yield of rice.

	Organic farming			Conventional farming		
	Kharif, 2015	**Kharif, 2016**	**Mean**	**Kharif, 2015**	**Kharif, 2016**	**Mean**
Tillers/ sq.mt	383	473	428	373	539	456
Panicles /m2	264	301	283	252	315	284
Filled grains/Panicle	169	240	205	136	214	175
1000 Grain wt (g)	20.28	20.69	20.49	19.57	20.10	19.84
Grain Yield (kg/ha)	5817	5506	5662	5150	5762	5456
Straw yield (Kg/ha)	7583	6717	7150	6917	7260	7089

Soil analysis data resulted that Organic carbon content of the soil was increased from 1.16 % to 1.32% under organic farming, while under inorganic farming it was increased marginally (1.16 to 1.21). 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 (Ponnamperuma, 1984) [8]. Increased enzyme activities in soils under organic management than under conventional management due to activities of micro-organisms was also reported by Melero *et al*. (2008) [6]. Comparable increases in organic carbon, available N, P and K through addition of organic materials was reported by Pathak *et al*. (1992) [7] and Yadvinder-Singh *et al*. (2004) [14].

Table 2: Effect of Organic farming on soil physico chemical and chemical properties

No	**Year**	**pH**		**E.C (dSm-1)**		**O.C (%)**		**Nitrogen**		**P_2O_5**		**K_2O**	
								Kg/ha					
		OF	**CF**	**OF**	**CF**	**OF**	**CF**	**OF**	**CF**	**OF**	**CF**	**OF**	**CF**
	Initial	**6.20**		**0.91**		**1.16**		**276**		**20.38**		**278**	
1	2015 -16	6.17	6.27	0.51	0.56	1.08	0.99	156	171	49.84	54.77	426	495
2	2016 -17	6.23	6.32	0.61	0.67	1.32	1.21	166	182	43.60	56.40	375	484

Nutrient uptake of nitrogen, phosphorus and potassium were also found to be high with organic farming than conventional farming, slight increase was observed during *Kharif*, 2016 under conventional farming.

Table 3: Effect of Organic farming on nutrient uptake of grain and straw of rice

S.No	Year	Organic						Inorganic					
		N (kg/ha)		P (kg/ha)		K (kg/ha)		N (kg/ha)		P (kg/ha)		K (kg/ha)	
		Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
1	2015	36.65	34.12	12.80	7.58	45.95	94.79	31.93	26.98	14.42	7.61	42.23	80.24
2	2016	51.21	36.28	15.97	6.72	41.85	77.25	53.05	42.84	17.29	7.99	46.10	84.22

Table 4: Effect of Organic farming on soil microbial properties and soil enzyme activities

	Total microflora (cfu/ g)	Organic	Conventional
1	Fungi (10^5)	7.2	4.2
2	Bacteria (10^3)	8.5	7.4
3	Actinomycetes (10^5)	7.1	5.7
	Enzymatic studies	Organic	Conventional
1	Urease (ug of NH4 released/ 5g of soil per 2hr)	8.10	7.20
2	Dehydrogenase (mg of TPF produced /g soil /day)	62.93	59.6
3	Acid Phosphatase (µ g of 4-nitrophenol released /g soil /hr)	73.24	69.5

Fig 1: Organic farming

Impact on soil microbial communities

Results revealed that, organic nutrient sources have a stimulating influence on the soil microbial communities as seen by the increase in microbial populations. Total bacterial, fungal and actinomycetes population were found to increase under organic farming. Soil microbial communities play an important role in maintaining soil fertility and productivity because they not only regulate transformation processes of elements in soils but also control the build up and break down of organic matter and decomposition of organic residues (Mandal *et al*, 2007) [5]. Microbial characteristics of soils, such as biomass, enzyme activity and diversity, are generally evaluated because of the clear relationships between these factors with soil quality and ecosystem sustainability (Doran and Parkin, 1994) [3]. Increased availability of substrates (C and N) required for microbial population build up could be the probable reason for this increase (Bunemann *et al*., 2006) [1]. Higher microbial diversity in organically managed soils was reported by Rao (2005) [9].

Conclusions: Yields of rice was found satisfactory with organic farming during *Kharif* season. Soil nutrient status were found superior in organic plots compared with inorganic plots. Using easily available local natural resources, organic farming can be practiced with a view to protect/preserve/safe guard our own natural resources and environment for a fertile soil, healthy crop and quality food and let our future generations enjoy the benefits of non-chemical agriculture. Given the same profitability, organic farming is more advantageous than conventional farming considering its contribution to health, environment, and sustainability.

References

1. Bunemann EK, Schwenke GD, Van Zwieten L. Impact of agricultural inputs on soil organisms- a review. Australian Journal of Soil Research. 2006; 44:379-406.
2. Chitra L, Janaki P. Combined effect of organic wastes and inorganic nutrients on the nutrient uptake and yield of rice in kar and pishanam seasons. Oryza. 1999; 36:327-330.
3. Doran JW, Parkin TB. Defining and assessing soil quality. p. In: J.W. Doran *et al*., (ed.) Defining Soil Quality for a Sustainable Environment. SSSA Spec. Publ. No. 35, Soil Sci. Soc. Am., Inc. and Am. Soc. Agron., Inc., Madison, WI, 1994, 3-21.
4. Mader P, Fliessbach A, Dubois D, Gunst L, Fried P, Niggli U. Soil fertility and biodiversity in organic farming. Science. 2002; 296:1694-1697.
5. Mandal Asit, Ashok K Patra, Dhyan Singh, Anand Swarup, Ebhin Masto R. Effect of long-term application of manure and fertilizer on biological and biochemical activities in soil during crop development stages. Bio resource Technology. 2007; 98(8):3585-3592.
6. Melero S, Madejon E, Herencia FJ, Ruiz JC. Effect of Implementing Organic Farming on Chemical and Biochemical Properties of an Irrigated Loam Soil. Agronomy Journal. 2008; 100:136-144.
7. Pathak H, Kushwala JS, Jain MC. Evaluation of Manurial value of Biogas spent slurry composted with Dry Mango leaves, wheat straw and Rock Phosphate on wheat crop. Journal of Indian Society of Soil Science. 1992; 40:752-57.
8. Ponnamperuma FN. Straw as source of nutrients for wet land rice. In Organic Matter and Rice 17-136. Philippines, Manila: International Rice Research Institute, 1984.

9. Rao DLN. Soil microbial diversity in chemical and organic farming. Paper presented at "National seminar on organic farming-Current Scenario and future thrust" during April 27-28, 2005 held at ANGR Agricultural University, Hyderabad, India, 2005, 61-64.
10. Sharma PD, Mohan Singh. Problems and prospects of Organic farming. Bulletin of the Indian Society of Soil Science. 2004; 22:14-41.
11. Surekha KV, Jhansilakshmi N, Somasekhar PC, Latha RM, Kumar N. Status of Organic Farming and Research Experiences in Rice. Journal of Rice Research. 2010; 3(1):23-35.
12. Tanaki M, Itani T, Nakano H. Japanese Journal of crop Science. 2002; 71(4):439-445.
13. Urkurkar JS, Chitale Shrikant, Tiwari Alok. Effect of organic v/s chemical nutrient packages on productivity, economics and physical status of soil in rice (*Oryza sativa*) – potato (*Solanum tuberosum*) cropping system in Chhattisgarh. 2010; 55(1):6-10.
14. Yadvinder-Singh, Bijay-Singh, Ladha JK, Khind CS, Khera TS, Bueno CS. Effects of Residue Decomposition on Productivity and Soil Fertility in Rice-Wheat Rotation. Soil Science Society of America Journal. 2004; 68:854-864.