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RESEARCH ARTICLE

Evaluation of rice varieties in organic and normal farmers practices

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Abstract:

Field experiments were conducted during Kharif 2007 and Rabi 2008 under organic practice and normal farmers' practice at Nariso village in Khurda district of Odisha to study the comparative effects of organic practice and normal farmers practice on rice production. Three rice varieties namely Oryza sativa cv Khandagiri and O.sativa cv. Sarala and local landrace O. sativa cv. Solari were transplated for this study. It was found that the rate of growth was higher in all the rice varieties cultivated in both Kharif and Rabi seasons by organic practice using organic manure, green manure and biopesticides in comparison to normal farmers' practice in which there was use of excess chemical fertilisers, pesticides and high cost machineries. The grain yield was found to be 4.5 t/ha and 3.4 t/ha in varieties Sarala and Solari respectively in organic practice where as it was 3.8 t/ha and 2.5 t/ha in normal farmers' practice. Similarly in Rabi season the variety Khandagiri yielded 4.8t/ha in comparison to 3.9t/ha in normal farmers' practice.

Key Words: Organic practice, Normal farmers practice, Rice growth, Yield, Sustainability.

Introduction

The traditional system of agriculture has been in practice more than ten thousand years and has been recognized as more sustainable than any other system of agriculture. In course of time, there was shortage of food grains to feed the ever increasing population and during late sixties Green Revolution was launched which led to a significant increase in rice production and India became a food grain (rice and wheat) surplus country. This achievement was primarily due to modernization of traditional practices with the use of seeds of high yielding varieties, chemical fertilizers and pesticides. But after about forty years, it was found that crop productivity and production has affected adversely. There is great loss of soil fertility and biodiversity thus affecting various ecosystems and enhancing the rate of emission of green house gases like CO_2, NO_2 thus leading to global warming and climate change, the most alarming global issue. Due to various problems in modern agricultural technology, organic farming has again emerged as the viable alternative. Organic farming is a system of agriculture that seeks to maintain and improve land as far as possible by encouraging and enhancing natural biological processes. It is farming of permanency and aimed at promoting plant, animal and human health.

Organic rice production and farming is also a holistic production management system which avoids the use of synthetic fertilisers, pesticides, and genetically modified seeds. To the maximum possible extent, organic farming system rely upon crop rotation, use of crop residues, animal manures, off-farm organic wastes, green manures, bio-fertilizers, bio-pesticides to maintain soil productivity and tilt to supply plant nutrients and to control insects , pests and weeds thereby combating environmental pollution .This ultimately helps to maintain sustainable rice production and ecosystem .Organic practices reduce the emission of greenhouse gases(Pantawat,2012).Use of organic manure improve the organic matter content which support the soil, micro and macro fauna and make the soil living body(Ramakrishnan et al,2005). Organic practice reduce the application of insecticide and pesticide by reducing the insect population(Chino et al,1987, Lotter et al,1999).It is also cost effective by increasing yield and high head rice recovery which helps our small and marginal farmers to sustain in rural areas of the country thereby maintaining its social, cultural and economic status(Surekha et al., 2010: Nguyen et al, 2002). In view of this the present study aimed at to study the implication of organic rice production for sustainable ecosystem and farming and compare the effect of organic practice and normal farmers practice.

Materials and methods

In Kharif 2007 two rice varieties namely *Oryza sativa* var. Sarala and an indigenous variety *Oryza sativa* var. Solari are transplanted for this study. The duration of Sarala and Solari is 150 and 135 days respectively.
In Rabi 2008, season *Oryza sativa var.*Khandagiri was taken as test crop which is high yielding and of 110 days duration. Healthy seeds were locally available and collected from Loka SomabayPratisthan(LSP),Nariso.

Field experiments were done by organic and normal farmer's Practice (NFP) at Nariso village of Khurda district, Odisha taking 25Cents (1/4th acre) for each variety for each treatment.

Organic practices:

Land Preparation:

The land was ploughed thoroughly with Bullock plough and farm yard manure (FYM) was evenly spread on the whole field. Then Dhanicha (*Sesbania aculeata*) seeds (2.5 kg) were sown and on the arrival of monsoon, puddling was done with 3-5cm of standing water in the field when dhanicha plants attained 1-1.5ft height leaving some plants at the periphery of the field for collecting seeds for the next season. Weeds along with the young dhanicha plants were threshed and mixed in the soil. By this the weed problem could be avoided to some extent. Then neem cakes (12 kg) were spread evenly throughout field. Puddling up to 10cm depth make the silty clay soil soft for the seedling to establish themselves faster, to minimize the leaching of nutrients and thereby increasing the availability of plant nutrients. .

Transplantation: Young, healthy seedlings at 4-5 leaf stage were transplanted which can establish themselves faster and grow better and give 15 percent more yield. In case of Kharif, 20-25 days seedlings were transplanted whereas in case of Rabi, 30-40 days seedling were transplanted . The spacing was 20X10 cm with 1 to2.5cm of standing water in labeled field.

Weeding: Early weeding (2weeks after planting) was done manually by male labourers. Second weeding was done manually by hand after four weeks to maintain weed free condition during growth period at 40-45 days after transplantation.

Pest and disease management: Spraying with fresh cow urine with water (1:5dilution) was done after 3 weeks of transplantation to prevent outbreak of pest and diseases. Neem oil cakes were also used during land preparation before transplantation to fumigate soil from different pathogens.

Use of Biofertiliser: Biofertilisers like Azotobacter (1kg) and Azospirillum (1kg) inoculants were applied to soil during vegetative growth period (3weeks after transplantation) to maintain soil productivity especially nitrogen content of soil. Besides that they suppressed the growth of pathogenic bacteria in soil and increased the yield by secreting growth promoting substances.

Organic Manures and nutrients Management: In Nariso Experiment , locally available organic manures like FYM(Farm yard manure), cow dung compost, crop residues, green manure (Dhanicha-*Sesbasia aculeata*) and Neem oil cakes were used as the source of major & minor plant nutrients like N,P,K,Zn, Fe, Mn etc. FYM & cow dung compost of about 2quintal, 12kg of Neem oil cakes, 2.5kg of Dhanicha seeds were used during land preparation before transplantation. Biofertiliser like Azospirillum and Azotobacter (1kg each) were applied to the soil 45days after transplantation which helps in atmospheric nitrogen fixation to improve the soil productivity. Handi Khata was also used as growth promoter to promote the growth of panicles and to reduce number of chaps (false grains).

Harvesting: Harvesting was done at the proper time when the grains were getting golden yellow in colour leaving few yellow green grains at the base of panicles so that it prevents losses in yield because of the shedding of grains. Harvesting too early to maturity or too late was not done to prevent yield loss. Harvesting was done after draining away of water so that the field became dry to facilitate manual harvesting. Crops were cut with sickle mainly by male laborers and then kept in the field for 3 to 4 days for drying under sun. Harvesting was done when the moisture content of the grain is about 20-25 percent. Then the harvest was kept for drying to reduce the moisture content to 13-14 percent before milling.

Storage: Paddy was stored either for the use as seed for the next season or for milling. Proper storage of the produce was done (200kg grains: 1kg neem oil cake) in the containers to avoid fungal attack, bad odour and bitter taste.

Paddy was stored as needed in jute bags or in container made up of rope, straw, bamboo or mud otherwise known as Kothi. Rice (husked rice), either semi polished or polished was also stored in jute bags.

Normal Farmers Practice:
Nursery raising: Preparation of seed bed was done taking 4cents of land for each variety. Chemical fertilizers like DAP (2 kg) for phosphate, potash (1 kg) for potassium, Urea (2 kg) for nitrogen and chemical soil fumigant like Carbofuran (500gm) were applied to the ploughed land.

Transplantation: An area of 25 cents was ploughed by bullock and irrigation was applied in the field. Then chemical fertilizers like DAP (6kg), Potash (3 kg), urea (6 kg) were broadcasted on the field followed by puddling using Power tiller. Then in 2-3 days interval after settling of the soil, transplanting operation was completed.

Application of fertilisers: After 15-20days of transplantation first dose of fertilizer (Urea-12kg) was administrated. Then after about two months of transplantation second dose of fertilizers like Urea (6kg), Potash (3 kg) and DAP (6 kg) were administered.

Weeding: Weeding was done twice in the whole period. First weeding was done after about one month and second after about two months after transplantation by spraying synthetic weedicides usually Heptachlor or Pretilachloro.

Pest and disease control: To control stem borer disease after one month of transplantation chemical pesticide like Carbofuran (1.5 kg) was administrated. Chemical pesticides like Bavistein (50 gm.) and Streptomycin (20 gm) were applied to control Rice Tungro disease which is most commonly seen.

Water management
The HYV rice variety consumed 30 percent more water in normal farming practice as compared to practices in the organic method. During puddling and transplantation 2"-3" water is needed, while after 15 days of transplantation 3"-4" of standing water is required. After 21 days of transplantation till 60 days the field needs to be flooded with 4"-5" of water because of use of chemical fertilizers**.**

Results and Discussions

Different parameters both vegetative and reproductive growth period like shoot length, root length, leaf number, tiller number, length of panicle, number grains per panicle, yield per hectare were recorded and analysed in three rice varieties . It was found that in all the three varieties more or less similar trend was observed in both organic farming and normal farmers' practice (NFP) but vegetative growth was more pronounced in rice plants cultivated by organic manner. (Table1-6).There was also marked reduction in different yield related parameters in all the three rice varieties in NFP in comparison to organic farming (Table1-6).

In the variety Solari, the tiller no, panicle length and yield were 23.5, 26.8cm and 3.4 t/ha respectively in organic practice where as these are 17.8, 23.6cm.,and 2.5 t/ha in normal farmers practice(table3 and 4). similarly in variety Sarala, the tiller no., panicle length, number of grains/panicle and yield were 24.5,24.7 ,190.5 and 4.5t/ha in organic practice where as these are 20.4,23.8 ,154.6 and 3.8 t/ha in farmers practice(table 5 and 6).In variety Khandagiri the tiller no, panicle length, number of grains /panicle and yield were 21.8, 22.8,172.6 and 4.8t/ha where as these are 18.5, 20.8,160.6 and 3.9t/ha in farmers practice.

In organic farming water requirement is 30 percent less as compared to chemical agriculture. The price of organically grown rice fetch high price in the market than inorganically grown rice. So it is highly profitable and environmentally sustainable.

Table 1. Effect of organic farming on various growth parameters of rice (*Oryza sativa* Var. Solari)

Sampling age (days)	Shoot length/ plant (cm) ± S.E *	Root length /plant (cm) ±S.E*	No. of leaves/ plant ± S.E*	No. of roots/plant± S.E*	No. of Tiller/ plant ± S.E*	Length of panicle (cm) ± S.E*	No. of grains/ panicle ± S.E *	Yield (t/ha)
45	49.84 ± 2.84	10.54 ± 0.25	36.48 ± 1.20	52.62 ± 4.56	1.00 ± 0.00	-	-	-
75	105.9 ± 4.54	18.84 ± 0.68	112.5 ± 1.38	560.8 ± 8.45	5.84 ± 0.45	18.45 ± 1.24	-	-
105	125.5 ± 4.86	22.48 ± 0.74	134.7 ± 4.12	1009 ± 8.94	20.42 ± 1.25	22.84 ± 2.22	-	-
135	130.4 ± 4.28	25.29 ± 0.95	116.98 ± 3.60	1200.2 ± 15.8	23.54 ± 2.64	26.84 ± 3.46	220.5 ± 10.6	3.4± 0.24

Table 2. Effect of normal farmer's practice(NFP) on various growth parameters of rice (*Oryza sativa* Var. Solari)

Sampling age (days)	Shoot length/ plant (cm) ± S.E *	Root length /plant (cm) ±S.E*	No. of leaves/ plant ± S.E*	No. of roots/plant± S.E*	No. of Tiller/ plant ± S.E*	Length of panicle (cm) ± S.E*	No. of grains/ panicle ± S.E*	Yield(t/ha)
45	51.47 ± 3.28	14.56 ± 0.85	40.64 ± 1.66	42.64 ± 4.84	1.80 ± 0.04	-	-	-
75	69.82 ± 4.54	17.86 ± 0.85	101.48 ± 1.84	464.45 ± 8.64	4.56 ± 0.42	16.86 ± 1.64	-	-
105	96.45 ± 3.82	20.20 ± 1.42	112.56 ± 3.84	838.72 ± 10.42	5.64 ± 1.06	21.84 ± 2.12	-	-
135	114.64 ± 4.86	22.24 ± 0.85	88.62 ± 3.68	900.48 ± 12.82	17.82 ± 2.64	23.64 ± 3.22	190.5 ± 5.84	2.5± 0.21

Table 3. Effect of organic farming on various growth parameters of rice (*Oryza sativa* Var. Sarala)

Sampling age(days)	Shoot length/ plant (cm) ± S.E *	Root length /plant (cm) ± S.E*	No. of leaves/ plant ± S.E*	No. of roots/plant± S.E*	No. of Tiller/ plant ± S.E*	Length of panicle (cm) ± S.E*	No. of grains/ panicle ± S.E *	Yield (t/ha)
45	48.25 ± 2.45	15.12 ± 0.56	20.42 ± 2.24	72.68 ± 4.28	1.00 ± 0.00	-	-	-
75	62.58 ± 2.54	22.64 ± 0.74	76.58 ± 4.68	680.56 ± 8.36	12.42 ± 0.48	12.24 ± 0.48	-	-
105	75.86 ± 4.46	30.86 ± 1.82	110.4 ± 4.26	810.52 ± 10.46	18.82 ± 1.05	18.82 ± 1.05	-	-
135	94.24 ± 4.64	33.66 ± 2.62	125.44 ± 4.26	960.54 ± 12.43	20.62 ± 1.48	22.52 ± 1.74	-	-
150	100.42±4.12	34.46 ± 2.34	105.7 ± 4.08	1002.3 ± 10.86	24.52 ± 2.42	24.72 ± 1.48	190.5 ± 4.84	4.5± 0.28

Table 4. Effect of NFM on various growth parameters of rice (*Oryza sativa* Var. Sarala)

45	52.42 ± 1.84	18.42 ± 0.68	18.42 ± 1.08	80.46 ± 4.06	1.70 ± 0.004	-	-	-
75	70.46 ± 2.34	24.12 ± 0.84	60.12 ± 3.48	540.82 ± 5.86	12,84 ± 0.22	10.68 ± 0.24	-	-
105	89.84 ± 4.28	27.28 ± 1.27	92.88 ± 4.12	748.84 ± 5.38	16.84 ± 1.26	16.42 ± 0.68	-	-
135	90.42 ± 4.68	29.46 ± 1.24	109.48 ± 4.74	802.46 ± 8.12	19.62 ± 1.86	21.84 ± 1.26	-	-
150	95.34 ± 4.88	32.42 ± 1.84	84.68 ± 4.06	860.68 ± 8.76	20.42 ± 2.05	23.84 ± 1.94	154.64 ± 5,28	3.8± 0.18

Table 5. Effect of organic farming on various growth parameters of rice (*Oryza sativa* Var. Khandagiri)

Sampling age (days)	Shoot length/ plant (cm) ± S.E *	Root length /plant (cm) ±S.E*	No. of leaves/ plant ± S.E*	No. of roots/plant± S.E*	No. of Tiller/ plant ± S.E*	Length of panicle (cm) ± S.E*	No. of grains/ panicle ± S.E *	Yield (t/ha)
30	42.45 ± 1.24	12.42 ± 0.64	22.84 ± 1.84	56.42 ± 2.56	-	-	-	-
60	78.28 ± 43.48	20.48 ± 2.64	82.42 ± 2.24	502.5 ± 4,82	5.24 ± 0.82	14.82 ± 0.64	-	-
90	85.45 ± 4.02	25.48 ± 2.58	120.4 ± 3.84	848.9 ± 6.42	18.42 ± 1.42	20.48 ± 1.04	-	-
110	90.24 ± 5.12	28.34 ± 2.74	108.4 ± 3.82	928.8 ± 5.62	21.82 ± 2.62	22.84 ± 1.08	172.64 ± 3.46	4.8± 0.32

Table 6. Effect of NFP on various growth parameters of rice (*Oryza sativa* Var. Khandagiri)

Sampling age (days)	Shoot length/ plant (cm) ± S.E *	Root length /plant (cm) ±S.E*	No. of leaves/ plant ± S.E*	No. of roots/plant± S.E*	No. of Tiller/ plant ± S.E*	Length of panicle (cm) ± S.E*	No. of grains/ panicle ± S.E *	Yield (t/ha)
30	45.08 ± 1.34	14.86 ± 0.46	20.88 ± 1.12	52.82 ± 2.88	-	-	-	-
60	68.27 ± 2.45	21.48 ± 1.64	78.08 ± 2.64	468.9 ± 4.82	4.94 ± 0.04	12.98 ± 0.44	-	-
90	82.60 ± 4.86	23.34 ± 2.08	104.58 ± 3.64	786.0 ± 5.48	16.46 ± 1.84	18.84 ± 0.08	-	-
110	85.14 ± 3.72	24.24 ± 1.98	88.68 ± 3.02	848.8 ± 5.62	18.56 ± 2.78	20.82 ± 1.12	160.84 ± 4.56	3.9± 0.21

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