



# Plant Archives

Journal homepage: <http://www.plantarchives.org>

DOI Url : <https://doi.org/10.51470/PLANTARCHIVES.2026.v26.supplement-1.356>

## PERFORMANCE OF TRADITIONAL PADDY (*ORYZA SATIVA* L.) VARIETIES UNDER ORGANIC PRODUCTION SYSTEM

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(Date of Receiving : 28-10-2025; Date of Acceptance : 02-01-2026)

### ABSTRACT

A field experiment was conducted to evaluate the response of traditional paddy (*Oryza sativa* L.) varieties to organic nutrient management practices for enhancing the growth, yield and quality in Tungabhadra Command area of Karnataka during *kharif* season of 2023-24 and 2024-25 at Agricultural Research Station, Dhadesugur. The experiment was laid out in randomised complete block design. It consisted of nine (9) treatments (traditional paddy varieties) viz., T<sub>1</sub>: Chinnaponni, T<sub>2</sub>: Siddasanna, T<sub>3</sub>: Navara, T<sub>4</sub>: Gandhasale, T<sub>5</sub>: Chittimuthyalu, T<sub>6</sub>: Hasada, T<sub>7</sub>: Narikela, T<sub>8</sub>: Sindhoora madhusale and T<sub>9</sub>: RNR-15048. Field investigation revealed that significantly higher grain yield and net returns was recorded in T<sub>2</sub>: Siddasanna (3411 kg ha<sup>-1</sup> & Rs.56,177 ha<sup>-1</sup>), T<sub>6</sub>: Hasada (3293 kg ha<sup>-1</sup> & Rs.52,809 ha<sup>-1</sup>) and T<sub>8</sub>: Sindhoora madhusale (3299 kg ha<sup>-1</sup> & Rs.50,277 ha<sup>-1</sup>) compared to other treatments. Whereas straw yield pattern changed due to genotypic characters of individual cultivars in addition to environmental response. Hasada (T<sub>6</sub>) (5451 kg ha<sup>-1</sup>) showed superiority over other treatments by recording significantly higher straw yield followed by Siddasanna (T<sub>2</sub>) (5083 kg ha<sup>-1</sup>) and Narikela (T<sub>7</sub>) (4611 kg ha<sup>-1</sup>).

**Keywords :** Traditional rice cultivars, Organic manures, Net returns.

### Introduction

Rice (*Oryza sativa* L.) is the necessary food crop for the majority of the people in Asia, predominantly in South India. India is the second largest producer and consumer of rice in the world. In Karnataka, Rice is mostly grown with traditional puddling and transplanting method. Drill planted rice is grown in the western ghats and other high-rainfall locations. In Northern Karnataka, Tungabhadra command area is known for rice production because of its favourable soil and climatic condition. In this region, rice-rice is the predominant cropping system and the crop is cultivated intensively with use of high levels of inputs like chemical fertilizers and pesticides.

Introduction of new high yielding varieties of rice for large scale cultivation have washed away all the

local varieties of rice for main stream. Unfortunately, the modern agriculture resulted in loss of valuable local germplasms. In addition to this, the present health conditions of people require more of nutritious food. So, in order to arrest the further loss of traditional crops and to produce nutritious food, traditional paddy cultivation is gaining importance. Malnad tracts and other parts of Karnataka still has several hundreds of traditional varieties of cereals and pulses which needs to be collected, conserved and popularized among the farming community before the extinct. Historically, farmers have conserved and cultivated a large number of traditional rice varieties since this serves several purposes. Traditional rice varieties are suited to the local climate and soil type and they have a high degree of resistance to pest and diseases and they are known

to have specific nutritional and therapeutic properties (Karpagalakshmi and Brindha, 2021).

Organic farming is the production system which excludes uses of chemical fertilizers, pesticides, growth regulators etc. and relies on crop rotation and use of animal manures, crop residues, legumes, green manures, organic farm wastes, biofertilizers and bio control pest management and use of natural fertilizer sources to supply plant nutrients for both crop production and maintaining soil quality and soil health (Surekha *et al.*, 2011). Organic agriculture is generally considered as sustainable production system due to less use of off-farm inputs, higher input-output efficiency and environmental benefits. Adaption of organic agriculture would help to mitigate the problems associated with input intensive conventional agriculture as it maintains soil productivity and pest control by enhancing natural processes and cycles in harmony with environment.

Traditional rice has a lot of medicinal properties and it will help to stay energetic and young. Red rice is mainly helping to restore tumours in the body. Traditional rice varieties contain thiamine, riboflavin, calcium, vitamin D, high fiber and glutamic acid. Some of the traditional varieties contain anthocyanin which is mainly used for antioxidative, anti-inflammatory and anti-carcinogenic. It contains less fat, low sugar, no gluten and also the presence of oryzanol- helps to block the cholesterol in the body. And hence traditional rice varieties are ideal food for diabetics and blood pressure patients. The use of improved rice varieties exhausted soil fertility more rapidly than traditional rice. Organic manures are the rich source of microflora and it contains enzymes, growth hormones and also it will increase the physio-chemical and biological properties of the soil. Organic manures increase the growth and yield of rice combined with biofertilizers like *PSB*, *ZSB*, *Azospirillum sp.* and *Phosphobacteria sp.* Traditional rice cultivation is being done in some pockets of Karnataka with minimum nutrient support. There is no specific nutrient recommendation for traditional rice varieties. There is awareness among the consumers as traditional rice are having high nutrient and medicinal properties; and the demand is increasing. Hence, this study will pave the way for increasing the productivity and profitability of traditional rice cultivation.

Traditional rice varieties are even though poor yielders but responsive to organic production management practices. Inorganic nutrient management leads to increased height of plants which results in lodging of crop, hence not favourable. However, in Tungabhadra irrigation command area, information on

good agronomic practices pertaining to organic nutrient management practices to enhance the production potential of traditional varieties and to maintain soil fertility is lacking. Hence, the present experiment is planned to know the agro-techniques for the cultivation of traditional rice varieties.

### Material and Methods

The experiment was carried out at Agricultural Research Station, Dhadesugur, University of Agricultural Sciences, Raichur during *kharif* of 2023-24 and 2024-25. The research center is located in agroclimatic zone III (Northern Dry Zone) of Karnataka and it is situated at latitude of 15° 69' N and 76° 89' E longitude with an altitude of 358 meters above the mean sea level. The soil of the experimental site is medium black clay in texture classified under the order *Vertisols*. The average annual rainfall at ARS, Dhadesugur, UAS, Raichur for the past 15 years (2007 to 2022) is 624.40 mm. The amount of rainfall received during 2023 was 431.6 mm. However, the distribution of rainfall was erratic. Crop was irrigated through lift irrigation from Tungabhadra River and hence in reality rainfall did not had any limiting effect on crop growth. The mean maximum and minimum temperature indicate that the experimental locality recorded maximum air temperature (40.55 °C) in the month of April-2023 and 2024. There was no much variation in the mean minimum temperature. The mean minimum and maximum relative humidity during the crop growth period were normal. However, these traditional paddy varieties are resistant to pest and disease attack due to its genetic character, so variation in temperature and relative humidity during experimental period which may result in pest and disease outbreak did not had detrimental effect on the crop. But, variation in climatic factors during crop growth period influenced growth and yield of crop. No crop protection measures were taken during conduct of experiment.

The experiment was laid out in Randomised Complete Block Design (RCBD). The experiment consisted of nine (9) treatments (traditional paddy varieties) *viz.*, T<sub>1</sub>: Chinnaponni, T<sub>2</sub>: Siddasanna, T<sub>3</sub>: Navara, T<sub>4</sub>: Gandhasale, T<sub>5</sub>: Chittimuthyalu, T<sub>6</sub>: Hasada, T<sub>7</sub>: Narikela, T<sub>8</sub>: Sindhoora madhusale, T<sub>9</sub>: RNR-15048 (Check). Farmyard manure was calculated in equivalent to recommended dose of nitrogen of transplanted rice (150 Kg N ha<sup>-1</sup>) based on their N contents. Farmyard manure was incorporated into the soil 15 days before transplanting for all the treatments uniformly. In main field the transplanting of paddy seedlings was done after puddling with the spacing of 20 cm × 10 cm. Two hand weeding were carried out at 25 and 50 days after transplanting. At physiological

maturity, plants from each net plot were harvested and panicles were separated, air dried, threshed, cleaned and weighed. Grain yield per hectare was worked out and expressed in kg ha<sup>-1</sup>. The straw yield of rice was recorded after complete sun drying the straw from each net plot and expressed in kg ha<sup>-1</sup>. Harvest index was estimated as per the formula suggested by Donald (1962).

$$HI = \frac{\text{Economic yield (kg ha}^{-1}\text{)}}{\text{Biological yield (kg ha}^{-1}\text{)}} \times 100$$

The net returns per hectare was calculated by deducting the cost of cultivation per hectare from the gross returns per hectare. Selling price fixed by university for the current year is considered for working out the economics for all respective varieties.

### Results and Discussion

Two years pooled data were discussed below. Significant differences in grain yield of traditional paddy varieties were observed during field investigation. It ranged from 2557 to 3411 kg ha<sup>-1</sup> (Table 1 & Fig. 1). Wide margin in grain yield indicates a significant difference in grain yield between varieties which shows productive potential of individual variety in combination with response to environment. Significantly higher grain yield was recorded in the variety Siddasanna (T<sub>2</sub>) (3411 kg ha<sup>-1</sup>) and it was found to be on par with the varieties Hasada (T<sub>6</sub>) (3293 kg ha<sup>-1</sup>) and Sindhoora madhusale (T<sub>8</sub>) (3299 kg ha<sup>-1</sup>). While, the variety Chinnaponni (T<sub>1</sub>) (2557 kg ha<sup>-1</sup>) recorded significantly lower grain yield compared to all other varieties. Straw yield also showed significant difference among various traditional paddy varieties under organic nutrition. It ranged from 3659 to 5451 kg ha<sup>-1</sup> indicating a huge margin between different traditional varieties which might be due to their genetic makeup in vegetation and also its adaptability to growing region and climatic factors. The variety Hasada (T<sub>6</sub>) (5451 kg ha<sup>-1</sup>) showed superiority over other treatments by recording significantly higher straw yield compared to other treatments and it was followed by the variety Siddasanna (T<sub>2</sub>) (5083 kg ha<sup>-1</sup>), Narikela (T<sub>7</sub>) (4611 kg ha<sup>-1</sup>) and Sindhoora madhusale (T<sub>8</sub>) (4505 kg ha<sup>-1</sup>). Whereas the variety Chinnaponni (T<sub>1</sub>) (3659 kg ha<sup>-1</sup>) recorded significantly lower straw yield compared to all other varieties. Yield differences due to varieties were recorded by Islam *et al.* (2013) who observed variable grain yield among varieties. The variation in grain yield among different varieties was due to the differential efficiency of these varieties in converting dry matter into grain. Variation in these parameters between varieties resulted in varied yield response among them under organic production system. Similar

findings were reported by Srilatha and Sharma (2011). The rice grain yield is a quantitative character influenced by many genes and strongly by the environment (Setiawati *et al.*, 2020).

The yield differences observed among traditional rice varieties might be due to increased tiller, dry matter production and yield attributing characters like number of panicles hill<sup>-1</sup>, number of filled grains panicle<sup>-1</sup> and test weight. An increase in yield could be related to improved photosynthate translocation from source to sink as a result of greater NPK uptake, which is responsible for quick and easy translocation. The favourable growth in terms of higher LAI and DMP with higher nutrient uptake along with increased yield attributes *viz.*, productive tillers m<sup>-2</sup>, panicle length and number of filled grains per panicle which resulted in producing higher grain yield (Indhirajith *et al.*, 2021 and Gagandeep *et al.*, 2016). The higher straw yield observed with some varieties may be due to better plant growth with higher dry matter production. Application of FYM equivalent to recommended dose of nitrogen recorded higher straw yield. Straw yield of a crop is closely related to the vegetative growth *viz.*, plant height, tiller numbers, number of leaves and final stand of a crop. Similar observations were reported by Tulasi (2007) who stated that that application of 100 per cent fertilizer substitution with FYM gave higher straw yield in basmati rice.

Higher harvest index was recorded in RNR-15048 (T<sub>9</sub>) (0.42). This might be due to higher economic grain yield compared to other traditional rice varieties. The higher harvest index accounted was attributed due to higher translocation of carbohydrates from source to sink that produced higher grain and lower straw yield (Singh *et al.*, 2007).

The variety Siddasanna (T<sub>2</sub>) (Rs.56,177 ha<sup>-1</sup>) recorded significantly higher net returns over all other varieties and it was on par with the varieties Hasada (T<sub>6</sub>) (Rs.52,809 ha<sup>-1</sup>) and Sindhoora madhusale (T<sub>8</sub>) (Rs.50,277 ha<sup>-1</sup>). Same trend was seen in case of gross returns also. Higher yield and market price are two factors which influenced in increasing the net returns of these varieties compared to other varieties. For successful crop production economic efficiency and viability of crop cultivation are essential. Income from a crop is determined by its yield level, produce market price and cost incurred on its cultivation. Eventually, under similar cost of production, the cultivars produced higher yields provide more returns and benefit per rupee invested. A similar finding was reported by Hussain *et al.* (2008) and Solaippan (2002) stated that varieties differed among themselves for the monetary returns.

### Conclusion

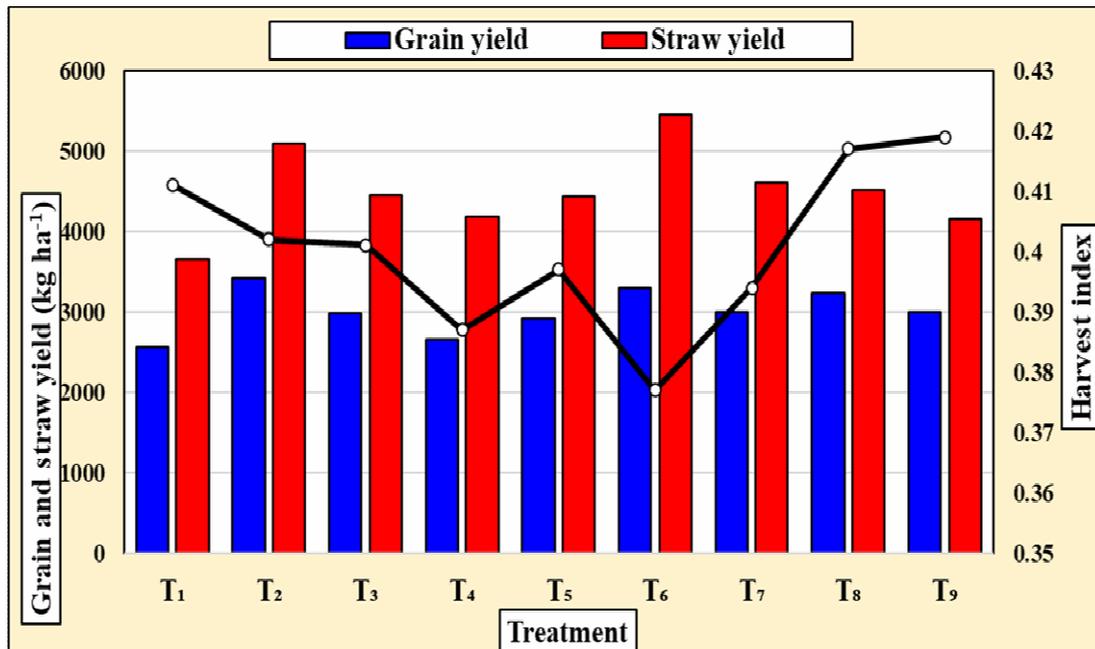
Among various traditional rice cultivars, Siddasanna recorded higher grain yield and net returns compared to other varieties. Based on experimental results, it can be summarized that traditional paddy varieties performed well under organic system and also

can be recommended for the farmers producing the organic manure in their own farms to reduce the cost of cultivation and to increase profitability and sustainability. In addition, if the premium price is considered for the organically grown paddy the net returns will be also more

**Table 1 :** Grain yield, straw yield, harvest index and net returns of traditional paddy varieties as influenced by organic nutrition

Treatment	Yield parameters									Economics		
	Grain yield (kg ha <sup>-1</sup> )			Straw yield (kg ha <sup>-1</sup> )			Harvest index			Net returns (Rs. ha <sup>-1</sup> )		
	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled	2023-24	2024-25	Pooled
T1	2482	2631	2557	3605	3713	3659	0.41	0.41	0.41	27766	31317	29542
T2	3372	3450	3411	5052	5114	5083	0.40	0.40	0.40	55539	56814	56177
T3	2931	3028	2980	4386	4517	4451	0.40	0.40	0.40	41747	43761	42754
T4	2602	2700	2651	4154	4223	4188	0.38	0.39	0.39	31714	33708	32711
T5	2861	2974	2917	4371	4501	4436	0.40	0.40	0.40	39627	42129	40878
T6	3221	3364	3293	5371	5531	5451	0.37	0.38	0.38	51108	54510	52809
T7	2963	3037	3000	4550	4672	4611	0.39	0.39	0.39	42831	44127	43479
T8	3181	3277	3229	4445	4565	4505	0.42	0.42	0.42	49292	51261	50277
T9	2951	3044	2997	4106	4210	4158	0.42	0.42	0.42	36626	38315	37470
S.Em ±	95	109	102	89	113	101	0.01	0.01	0.01	2823	3263	3030
CD at 5 %	284	328	305	267	340	303	0.02	0.03	0.02	8463	9783	9084

Note: Application of FYM equivalent to 100% RDN common to all treatments (RDF:- 150:75:75 kg N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O ha<sup>-1</sup>).



**Fig. 1:** Grain yield, straw yield and harvest index as varied among different traditional paddy varieties under organic nutrition

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