E-ISSN: 2618-0618
P-ISSN: 2618-060X

NAAS Rating (2025): 5.20
www.agronomyjournals.com
2025; 8(12): 454-457
Received: 09-09-2025
Accepted: 11-10-2025

Sangeeta Meher
Department of Agronomy, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha, India

RK Paikaray
Department of Agronomy, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha, India

Sarita Barla
Department of Agronomy, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha, India

Corresponding Author:
Sangeeta Meher
Department of Agronomy, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha, India

Effect of organic nutrient management on growth, yield and yield attributes of black rice

Sangeeta Meher, RK Paikaray and Sarita Barla

DOI: https://www.doi.org/10.33545/2618060X.2025.v8.i12g.4413

Abstract
A field experiment was conducted on Nutrient management in black rice through organic source during *kharif* season, 2020-21 at Agronomy main Research Station, Odisha University of Agriculture and Technology, Bhubaneswar in randomized block design with three replications. The treatment consisted of eight organic nutrient management practices i.e. T_1- Straw (5 t/ha) + waste decomposer (250 l/ha), T_2- FYM (10 t/ha), T_3 - Growth G (15 kg/ha), T_4- High grow GR (15 kg/ha), T_5- T_2+ Growth G (15 kg/ha), T_6- T_2 + High grow GR (15 kg/ha), T_7- FYM (10 t/ha) + Growth G (15 kg/ha) + High grow GR (15 kg/ha) and T_8 - Control. The black rice variety 'Kalabati' was grown as the test crop. Application of FYM 10t/ha + Growth G 15kg/ha + High grow GR 15 kg/ha produced maximum plant height (150.4cm), number of tillers/hill (17.67), dry matter accumulation (25.24 g/hill), number of panicles/hill (16.67), number of grains per panicle (110.33) and test weight (23.87 g) which resulted to production of highest grain yield (3154.3 kg/ha). The grain yield obtained with FYM 10t/ha + Growth G 15 kg/ha + High grow GR 15 kg/ha was at par with FYM 10 t/ha + Growth G 15 kg/ha.

Keywords: Black rice, organic nutrient management, growth components, yield and yield attributes

Introduction
Rice is the most common food in South Asia, particularly in the Indian subcontinent. Transluscent rice (approximately 85%) is commonly used for consumption, with the remainder being pigmented rice. Pigmented rice has been consumed for a long time throughout Asia, namely in China, Japan, Korea, and a few other Southeast Asian countries (Tananuwong *et al*., 2010) [10]. Sukhonthara *et al*. (2009) [9] categorized red and black rice, both of which are grown in Japan, as *Oryza sativa* L. The anthocyanin pigment gives the hulled rice a red and brownish red colour in red rice and a dark purple appearance in black rice. The naming of rice is related to the colour of its kernel (Sampong *et al*., 2011) [7]. The presence of the anthocyanin pigment on the outer layers (bran) of the rice kernel gives black colour in rice. Black rice is native to north-east India and is widely planted in Odisha, West Bengal, and Jharkhand.

Black rice is having medium-sized grain with a black husk on the outside and a plethora of health advantages on the inside Tocopherols (vitamin E), iron, and antioxidants are abundant in black rice. Each grain contains anthocyanin, a powerful antioxidant that gives it a distinct colour. It is also a natural detoxifier and its consumption helps to prevent diseases like atherosclerosis, diabetes, alzheimer's, hypertension, cholesterol, arthritis, allergies, ageing signs.

The increasing cost of chemical fertilizer and growing awareness of the health and environmental issues associated with the intensive use of chemical inputs, there is a growing interest in organic agriculture which is a holistic production management system that promotes agro-ecosystem, health and biodiversity. Organic manures have been demonstrated to be effective in halting productivity declines by correcting secondary and micronutrient deficiencies as well as influencing the physical and biological aspects of soil (Pandey *et al*., 2007) [6]. Straw incorporation has the potential to have major long-term effects on soil nitrogen delivery. Crouch *et al*. (1994) [2] and Khan *et al*. (2009) [3] found that seaweed extract contains macro elements, microelements, vitamins, fatty acids, amino acids, and growth regulating hormones such auxin, cytokinin, gibberellins, and abscisic acid. Root growth and development, shoot growth,

photosynthesis, plant vigour, and fruit ageing. Taking into account all of these aspects, the experiment was conducted to determine the effect of organic source of nutrients on growth, yield attributes of black rice under organic nutrient management.

Materials and Methods

The experiment was performed at Agronomy main Research Station, Odisha University of Agriculture and Technology, Bhubaneswar. The research station is located under the East and South East coastal plain agro-climate zone of Odisha. The soil texture was sandy loam in texture. The initial soil fertility status, particularly pH 5.31, organic carbon content (0.43%), available N (241.8 kg ha^{-1}), available P (29.6 kg ha^{-1}) and available K (144.2 kg ha^{-1}) was estimated in the laboratory at the beginning of the experiment. The experiment was laidout in a Randomized Block Design with eight treatments (6m × 4m plots) and three replications. The following treatments were set:. T_1- Straw (5 t/ha) + waste decomposer (250 l/ha)**,** T_2- FYM (10 t/ha), T_3 - Growth G (15 kg/ha), T_4- High grow GR (15 kg/ha), T_5- T_2+ Growth G (15 kg/ha), T_6- T_2 + High grow GR (15 kg/ha), T_7- FYM (10 t/ha) + Growth G (15 kg/ha) + High grow GR (15 kg/ha) and T_8 - Control. The variety used in this study was 'Kalabati'.

On 11th July 2020, the sowing was completed in a nursery bed with specified rate. The layout and final leveling of the main field were completed in accordance with the layout design. Before the seedlings were transplanted, various organic sources such as straw @ 5 t/ha + waste decomposer @ 250 l/ha, FYM @10 t/ha, Growth G @ 15kg/ha, and High grow GR @15 kg/ha were applied on the same day of transplantation into the main field according to the layout developed for the various treatments. Seedlings were uprooted from the nursery bed on the day of transplanting. On 2nd August 2020, seedlings were transplanted in the main field at a spacing of 15cm× 15cm. Two seedlings were transplanted per hill. It was pruned once during vegetative growth after 2-3 months of growth, when it reached 2 to 3 feet in height, to encourage more productive tillers and to boost total productivity per unit area.

Growth Components

Plant height of Black rice was measured from the base of the hill to the tip of the tallest leaf or panicle at 15, 30, 45, 60, 75, 90, 105DAT and at harvest. Finally, average plant height was calculated for each stage and expressed in centimetres. At 15, 30, 45, 60, 75, 90, 105 DAT and during harvest, the total number of tillers/hill was recorded. The mean value of five plants at different developmental stages was statistically evaluated. At each sampling date, a third leaf from the top was taken as fresh and the leaf area was measured using a leaf area meter. It was calculated in terms of total leaf area per unit ground surface area.

$$LAI = \frac{Total\ leaf\ area\ (m2)}{Unit\ land\ area\ (m2)}$$

For estimation of dry matter accumulation, three hills were uprooted out from each plot, with the exception of two boarder rows, and then cleaned, with roots, stems, and leaves separated. The samples were air dried for 24 hours before being dried in a hot air oven at 80 °C for 72 hours to get a consistent weight. The average dried weight of the leaf and stem was weighed and then calculated to gram per hill.

Yield and Yield Parameters

Different yield, yield attributing parameters were recorded time to time and The yields of grain and straw were recorded and recalculated to per hectare basis.

1. Number of panicles per hill

At the harvest stage, the total number of panicles per hill was counted from a randomly selected five hills in each plot and the mean number of panicles from each hill was statistically analyzed.

2. Number of grains per panicle

The total number of grains per panicle from randomly selected plants was counted and a mean was calculated based on that.

3. Length of panicle (cm)

Ten panicles were randomly selected, and their lengths were measured in centimetres from the neck node to the tip of the apical grain and an average was calculated to determine the panicle's mean length.

4. Test weight (g)

Thousand grains were counted and weighed from the grain yield of five randomly selected plants to determine the test weight or thousand grain weight.

5. Grain yield and straw yield (q/ha)

The grains and straw from the harvested plot from the corresponding net plot were threshed and dried in the sun for three days. Grain and straw weights were individually recorded and then expressed to kg per hectare.

6. Harvest index (HI)

Harvest index was calculated by following formula, which is expressed as a percentage.

$$HI = \frac{Economic\ yield}{Biological\ yield} \times 100$$

For Randomised Block Design, data collected from numerous observations was statistically evaluated using the conventional analysis of variance approach (ANOVA). To interpret the results, the standard error of mean SE (m) ± and critical difference (CD) were calculated at the 5% probability level.

Results and Discussion

Yield being a complex character, is the sum of morphological, physiological and biochemical events that occur during the crop growth and development. This is determined by factors related to environmental conditions under which the crop is grown, genetic potential of the crop and crop management practices. Hence, yield of crop cannot be attributed to only one of the factor in most of the conditions.

Growth components

Higher plant height, number of tillers/hill, LAI and dry matter accumulation were recorded at various stages of crop with FYM (10 t/ha) + Growth G (15 kg/ha) + High grow GR (15 kg/ha) (Table 1). Plant height of 150.4 cm obtained with FYM 10 t/ha + Growth G 15 kg/ha + High grow GR 15 kg/ha was highest at harvest which was at par with FYM 10t/ha + Growth G 15 kg/ha (149.8 cm) and FYM 10 t/ha + High grow GR 15 kg/ha (149.7 cm). The variation in plant height might be explained as, plant height is genetically controlled character and can be influenced by the environmental factors, crop management practices and organic sources of nutrients provided to the crop.

Yield attributes and yield

The number of tillers/hill increased progressively up to 75 DAT, after that this declined till the harvest stage of crop irrespective of treatments. The maximum number of tillers/hill (19.33) was observed at 75DAT with FYM 10 t/ha + Growth G 15 kg/ha + High grow GR 15 kg/ha which was at par (18.33) with application of FYM 10 t/ha + Growth G 15 kg/ha. The data revealed that LAI increased up to 75 DAT, later on it declined irrespective of the treatments. Dry matter accumulation increased continuously till harvest irrespective of the treatments. Similar results were also reported by Sunarpi *et al*. (2010) [8]. The improvement in all above growth characters might be due to supply of good amount of organic nutrient sources which helped in providing the macro nutrients, micronutrient along with plant growth promoting hormones, which helped in production of more LAI and increased the chlorophyll content of leaves for better utilization of solar radiation led to higher photosynthetic rate and finally more accumulation of dry matter. Another reason for the improvement in all above the growth characters might be due to sufficient translocation of carbohydrates to the sink.

Grain yield of black rice obtained from FYM 10 t/ha + Growth G 15 kg/ha + High grow GR 15 kg/ha was maximum (3154.3 kg/ha), which was at par with FYM (10 t/ha) + Growth G (15 kg/ha) producing 3062.1 kg/ha. At the same time, it increased the panicles per hill, number of grains per panicle and test weight over control (Table 2 and Fig. 1). The grain yield in rice is a result of three main yield attributes *viz*. number of panicles per hill, number of grains per panicle and test weight. These require a good supply of photosynthates to the sink from source which is depends on vigour of the plant growth and development during vegetative phase and requires ample amount of nutrient supply. These are also in conformity with the studies undertaken by Kumari *et al*. (2010) [5] and Kulhare *et al*. (2014) [4].

Table 1: Effect of organic nutrient management on growth components of black rice

Treatment		Plant Height (cm) at harvest	No. of tillers per hill at 75 DAT	LAI at 75 DAT	Dry matter accumulation at harvest
T_1	Straw 5 t/ha + waste decomposer 250 l/ha	146.8	14.33	5.46	22.81
T_2	FYM 10 t/ha	148.1	16.33	5.95	23.03
T_3	Growth G 15 kg/ha	149.2	17.33	6.37	24.12
T_4	High grow GR 15 kg/ha	148.5	16.67	5.96	23.84
T_5	$T_2 + T_3$	149.8	18.33	6.62	24.96
T_6	$T_2 + T_4$	149.7	17.67	6.51	24.62
T_7	$T_2 + T_3 + T_4$	150.4	19.33	6.72	25.24
T_8	Control	140.2	11.67	5.43	21.11
SEm (±)		0.30	0.48	0.13	0.10
CD(0.05)		0.92	1.43	0.39	0.31

Table 2: Effect of organic nutrient management on yield attributes and yield of black rice

Treatment		Panicles/ Hill	Grains/ Panicle	Length of panicle (cm)	Test Wt. (g)	Grain (kg/ha)	Straw (kg/ha)	HI (%)
T_1	Straw 5 t/ha + waste decomposer 250 l/ha	12.33	83.00	22.40	21.57	2351.0	4387.0	34.89
T_2	FYM 10 t/ha	13.67	104.20	23.07	22.37	2681.1	4781.5	35.93
T_3	Growth G 15 kg/ha	14.67	92.10	23.73	22.97	2740.6	4763.3	36.52
T_4	High grow GR 15 kg/ha	15.00	93.30	23.63	22.73	2719.0	4745.7	36.42
T_5	$T_2 + T_3$	15.67	106.33	24.30	23.57	3062.1	4831.6	38.79
T_6	$T_2 + T_4$	15.33	105.33	23.77	23.40	2830.7	4775.8	37.21
T_7	$T_2 + T_3 + T_4$	16.67	110.33	25.10	23.87	3154.3	4869.8	39.31
T_8	Control	9.70	86.70	20.10	17.35	2112.5	4215.2	33.38
SEm (±)		0.53	1.75	0.33	0.34	31.12	28.72	0.32
CD(0.05)		1.57	5.17	0.98	1.02	94.38	87.12	0.97

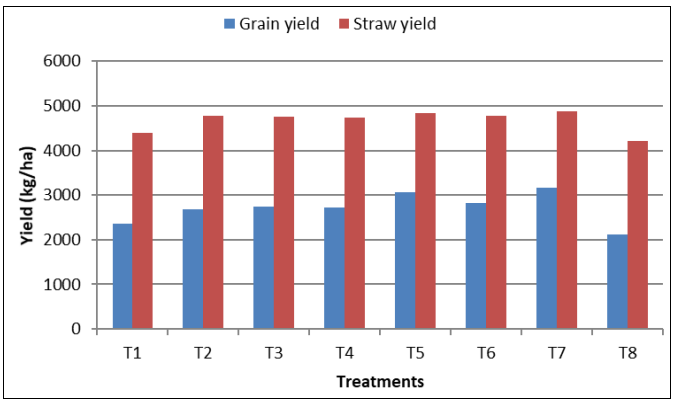

Fig 1: Effect of organic nutrient management on yield of black rice

Conclusion

From the above study, it was revealed that application of FYM 10 t/ha + Growth G 15 kg/ha + High grow GR 15 kg/ha produced the highest grain yield (3154.3 kg/ha) which was at par with FYM10 t/ha + Growth G 15 kg/ha (3062.1 kg/ha). Further, the harvest index with application of FYM 10 t/ha + Growth G 15 kg/ha + High grow GR 15 kg/ha (39.31%) was at par with FYM10 t/ha + Growth G 15 kg/ha (38.79%). This study concludes in favour of combined application of FYM 10 t/ha + Growth G 15 kg/ha + High grow GR 15 kg/ha in black rice resulted in highest growth, yield and harvest index.

Conflict of Interest: None

References

1. Bhattacharya SP, Sitangshu S, Karimadkar AJ, Bera PS, Latika M, Sarkar S, *et al*. Effects of humic acid (earth) on the growth and yield of transplanted summer rice. Environ Ecol. 2003;21(3):680-683.
2. Crouch IJ, Staden JV. Commercial seaweed products as biostimulants in horticulture. J Home Consum Hortic.

1994;1(1):19-76.
3. Khan W, Rayirath UP, Subramanian S, Jithesh MN, Rayorath P, Hodges DM, *et al*. Seaweed extracts as biostimulants of plant growth and development. J Plant Growth Regul. 2009;28:386-399.
4. Kulhare PS, Sharma GD, Sharma BL, Khamparia RS. Direct and residual effect of Zn and organic manures on yield, Zn content and uptake in a rice-wheat sequence on a Vertisol. J Indian Soc Soil Sci. 2014;62(3):274-279.
5. Kumari N, Singh AK, Pal SK, Thakur R. Effect of organic nutrient management on yield, nutrient uptake and nutrient balance sheet in scented rice (*Oryza sativa*). Indian J Agron. 2010;55(3):220-223.
6. Pandey N, Verma AK, Anurag, Tripathi RS. Integrated nutrient management in transplanted hybrid rice. Indian J Agron. 2007;52(1):40-42.
7. Sampong R, Ehn SS, Martin GL, Berghofer E. Physicochemical and antioxidant properties of red and black rice varieties from Thailand, China and Sri Lanka. Food Chem. 2011;124(1):132-140.
8. Sunarpi, Jupri A, Kurnianingsih R, Julisaniah NI, Nikmatullah A. Effect of seaweed extracts on growth and yield of rice plants. Nusantara Biosci. 2010;2(2):73-77.
9. Sukhonthara S, Chockchai T, Mitsuo M. Characterization of volatile aroma compounds from red and black rice bran. J Oleo Sci. 2009;58(3):155-161.
10. Tananuwong K, Tewaruth W. Extraction and application of antioxidants from black glutinous rice. Food Sci Technol. 2010;43(3):476-481.