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INFLUENCE OF DIFFERENT ORGANIC NUTRIENT SOURCES ON GROWTH, YIELD AND YIELD ATTRIBUTES OF RICE (*Oryza sativa* L.)

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ABSTRACT

The field experiment was conducted during *kharif* season of 2025 at Organic farm, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat. The experiment was laid out in Randomized Block Design having eight treatments *viz.*, T_1: 100 % RDN through NADEP compost, T_2: 80 % RDN through NADEP compost + Biochar 2t/ha, T_3: 80 % RDN through NADEP compost + Biochar 2t/ha + *Gliricidia* based formulation (GBF) 1250l/ha, T_4: 80 % RDN through NADEP compost + Biochar 2t/ha + GBF 3 % foliar spray (FS), T_5: 80 % RDN through NADEP compost + Biochar 2t/ha + GBF 1250l/ha + GBF 3 % (FS), T_6: 80 % RDN through NADEP compost + Biochar 2t/ha + Novel organic liquid nutrient 1 % (FS), T_7: 80 % RDN through NADEP compost + GBF 1250l/ha + GBF 3 % (FS) and T_8: Ghan-jivamrut 2t/ha + FYM 2t/ha + Jivamrut 1250l/ha + Jivamrut 20% (FS) with three replication. The result revealed that the application of T_5 *i.e.* 80% RDN through NADEP compost + Biochar 2t/ha + GBF 1250l/ha + GBF 3% (FS) produced significantly higher growth and yield attributes as well as yield of rice *i.e.* plant height at 60, 90 DAT and at harvest (81.3, 103.4 and 104.2 cm), no. of tillers/m^2 at 60 DAT (236.2), no. of productive tillers/m^2 (194.6), no. of grains/ panicle (233.7), panicle weight (5.33 g), grain yield/hill (16.3 g), straw yield/hill (33.4 g), grain yield (4154 kg/ ha) and harvest index (40.6%) which was found statistically similar with treatment T_7 *i.e.* 80% RDN through NADEP compost + GBF 1250l/ha + GBF 3% (FS).

***Key words*:** Rice, Biochar, Ghan-jivamrut, Jivamrut, *Gliricidia* based formulation, NADEP compost, Novel organic liquid nutrient, Organic farming, Productivity

Introduction

As the staple food for over half of the global population, rice (*Oryza sativa* L.) remains indispensable to global food and nutritional security. Its cultivation is concentrated in tropical and subtropical regions, particularly across Asia, often referred to as the “rice bowl” of the world. Nearly 90% of global rice production originates from Asian countries, with China and India collectively contributing more than half of the world’s total production. Rice is a rich source of carbohydrates and provides essential nutrients making it a vital part of the diet for millions of India. It is also used to make beverages such as rice milk and rice wine (sake), rice husk, a byproduct of rice milling can be used to make biodegradable packaging materials reducing environmental waste. Rice straw can be processed into fibers and used to make textiles and paper products. (Yellala *et al*., 2024).

In India, rice play a major role in diet, economy, employment, culture and history. India is the second largest producer of rice in the world. Rice was cultivated over an area of 52.17 million hectares during 2025-26, with a total production of 154.02 million tonnes and an average productivity of 2.95 t/ha. During 2025-26, Uttar Pradesh emerged as the leading rice-producing state in India with a production of 19.81 million tonnes, followed by Telangana (18.53 million tonnes), West Bengal (17.14

million tonnes), Punjab (12.53 million tonnes) and Andhra Pradesh (10.59 million tonnes). These five states together accounted for a substantial share of the country's total rice production, highlighting their significant contribution to national food security and the rice economy (Anon., 2026a). In Gujarat, rice is cultivated in an area of 1.179 million hectares with total production of 2.23 million tonnes and productivity 1.89 t/ha. The rice growing area of the state covers districts of Valsad, Navsari, Dangs, Surat, Bharuch, Narmada, Vadodara, Kheda, Anand, Dahod and Panchmahal (Anon., 2026b).

While, the green revolution transformed global agriculture by boosting crop productivity and ensuring food security, its long-term dependence on chemical-intensive farming has raised serious concerns regarding soil health, environmental sustainability and ecosystem resilience. In response, organic farming has emerged as a future-oriented and sustainable production system that restores soil fertility, strengthens biological activity, minimizes synthetic inputs and supports environmentally responsible agriculture.

NADEP method of composting is an aerobic process in which easily available input sources of organic matter such as crop residue, weeds, forest litter, kitchen waste, *etc*. are used and serves as a good alternative to farmyard manure. It is a good quality black or brown compost rich in plant nutrients and can easily hold soil moisture. It reduces the cost of cultivation as all the materials are easily available on-field (Kumawat *et al*., 2017).

Biochar is also effectively used in organic crop production and is a carbon-rich material produced through the pyrolysis of organic biomass under limited or no oxygen conditions which gained significant attention in recent years due to its potential role in improving soil fertility, enhancing crop productivity and mitigating climate change (Lehmann, 2007).

Enriched banana pseudo stem sap is proving itself as a remedy for the harmful effect caused due to inorganic farming. A patent product "NOVEL- Liquid Organic Nutrient" has been developed by the Banana Pseudo-stem Processing Unit, Navsari Agricultural University, Navsari, Gujarat. It promotes crop growth, protect crop from harmful pest and enhances crop yield (Salunke, 2010).

The nutrient-rich biomass of *Gliricidia* and its rapid decomposition contribute to improved soil organic carbon, moisture retention, and microbial activity, making it an excellent organic nutrient source (Srinivasa Rao, 2011).

A good alternative can be the cow based organic nutrient sources like jivamrut, bijamrut, panchagavya, ghan-jivamriit, *etc*. which helps to enhance microbial activity of soil which improves its fertility. It is eco-friendly and helps to yield good quality produce (Kaur, 2020). Keeping all the points in view the above fact, the experiment was conducted to find out the impact of different nutrient sources on rice (*Oryza sativa* L.) under organic farming.

Materials and Methods

The experiment was carried out at Organic Farm, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat, India during the *kharif* season of 2025.

The experiment was laid out in Randomized Block Design having eight treatments *viz.*, T_1: 100 % RDN through NADEP compost, T_2: 80 % RDN through NADEP compost + Biochar 2t/ha, T_3: 80 % RDN through NADEP compost + Biochar 2t/ha + *Gliricidia* based formulation (GBF) 1250l/ha, T_4: 80 % RDN through NADEP compost + Biochar 2t/ha + GBF 3 % foliar spray (FS), T_5: 80 % RDN through NADEP compost + Biochar 2t/ha + GBF 1250l/ha + GBF 3 % (FS), T_6: 80 % RDN through NADEP compost + Biochar 2t/ha + Novel organic liquid nutrient 1 % (FS), T_7: 80 % RDN through NADEP compost + GBF 1250l/ha + GBF 3 % (FS) and T_8: Ghan-jivamrut 2t/ha + FYM 2t/ha + Jivamrut 1250l/ha + Jivamrut 20% (FS) with three replication. Here, soil application of organic sources *i.e.* NADEP compost, biochar, ghan-jivamrut and FYM had done before transplanting and jivamrut and GBF @ 1250 l/ha each at 15, 30 and 45 DAT was applied as per the treatments. However, the foliar applications of liquid organic nutrients such as GBF, Novel Organic liquid nutrient and jivamrut were applied at 15, 30 and 45 DAT as per the treatment.

The rice cultivar GNR-7 was transplanted on 9th July 2025. The experimental field was prepared one month before transplanting by ploughing followed by harrowing using tractor-drawn implements. Thereafter, a 5 cm depth of standing water was maintained for puddling, which was carried out using a tractor-drawn puddler and followed by planking to achieve proper land leveling before transplanting. Thirty three day old seedlings were transplanted at a spacing of 20 cm between rows and 15 cm between plants. Two to three seedlings were transplanted per hill. Irrigation was applied as required to ensure proper crop growth and development. Favorable weather conditions prevailed throughout the cropping period, facilitating optimal growth and development of the rice crop.

Observations on growth and yield parameters were recorded from five randomly selected and tagged plants in each treatment across all three replications. The observations were measured manually and averaged to obtain values on a per plant basis. The panicle length

(cm), panicle weight (g) and no. of grains/panicle in five plants were measured and averaged to get per plant basis. Grain and straw yields were recorded from the net plot area at harvest and expressed as kg/ha by converting the plot yield to a hectare basis. While the harvest index was calculated using the formula (Donald, 1963):

$$\text{Harvest index (\%)} = \frac{\text{Economic yield (kg/ha)}}{\text{Biological yield (kg/ha)}} \times 100$$

Results and Discussion

Growth attributes

A progressive increase in plant height was observed from 30 DAT to harvest across all treatments. No significant differences in plant height were observed among the treatments at 30 DAT. Nevertheless, T_5 recorded the maximum plant height (64.2 cm), while the minimum plant height (56.7 cm) was registered under T_2 at 30 DAT. It might be due to the slow nutrient release from organic sources and sufficient nutrient availability from the soil during the early growth stage. However, significant differences were observed at 60 DAT, 90 DAT and at harvest. At 60 DAT, treatment T_5 registered significantly higher plant height (81.3 cm) and remained statistically comparable with T_1(75.3 cm), T_4 (78.2 cm), T_6 (79.1 cm) and T_7 (80.7 cm), whereas the lower plant height (69.4 cm) was recorded under T_2. A similar trend was observed at 90 DAT, where T_5 recorded significantly higher plant height (103.4 cm) and it was found statistically at par with T_7 (100.6 cm), T_1(99.1 cm) and T_6 (91.8 cm). The lower plant height (84.1 cm) was observed under T_8. At harvest, T_5 continued to maintain significantly higher plant height (104.2 cm) and it was found statistically similar with T_7 (101.4 cm) and T_1(99.5 cm). In contrast, T_8 registered the lower plant height (87.7 cm).

The improvement in plant height could be attributed to the positive effect of NADEP compost on crop growth may be due to its ability to supply essential nutrients and improve soil physical and chemical properties, thereby creating favourable conditions for plant development. Similarly, *Gliricidia* based formulations, owing to their high nitrogen content and rapid decomposition, might have enhanced nutrient release, nutrient mineralization and soil fertility, resulting in improved growth of the rice crop. The results obtained were by previous experiment carried out by Winarni *et al.*, (2016) in rice, Parmar *et al.*, (2017) in maize, Safiullah *et al.*, (2018) in maize and Jambhulkar *et al.*, (2024) in rice.

The number of tillers/m² at 60 DAT was significantly affected by different organic nutrient management. Significantly higher number of tillers/m² (236.2) were recorded under T_5 *i.e.* 80% RDN through NADEP compost + biochar @ 2 t/ha + GBF @ 1250 l/ha + 3% GBF foliar spray, which remained statistically at par with T_7 (228.5), T_1(229.4), T_4 (213.3) and T_6 (199.2). The lower number of tillers/m² (177.7) was observed under T_8.

Table 1: Effect of different organic nutrient sources on growth attributes of rice.

Treatments	Plant height (cm)				No. of tillers /m²
	At 30 DAT	At 60 DAT	At 90 DAT	At harvest	
T_1	62.6	75.3	99.1	99.5	229.4
T_2	56.7	69.4	87.9	89.8	194.9
T_3	61.6	71.3	89.6	90.9	182.4
T_4	64.1	78.2	91.1	93.1	213.3
T_5	64.2	81.3	103.4	104.2	236.2
T_6	63.6	79.1	91.8	93.0	199.2
T_7	63.0	80.7	100.6	101.4	228.5
T_8	57.4	69.7	84.1	87.7	177.7
SEm±	2.9	3.0	4.0	3.1	12.3
CD at 5%	NS	8.9	12.1	9.3	37.4
CV%	8.2	6.8	7.4	5.6	10.3

Yield attributes

The number of productive tillers/m² and grains/panicle at harvest was significantly influenced by different organic nutrient management practices. Among the treatments, T_5 registered significantly higher productive tillers/m² (194.6) and grains/panicle (233.7). The number of productive tillers/m² under T_5 was statistically at par with T_1(185.7), T_4 (171.7) and T_7 (183.2), while grains/panicle remained statistically comparable with T_7 (220.9), T_1(218.9), T_6 (215.4) and T_3 (212.9). Conversely, T_8 recorded the lower productive tillers/m² (143.9) and grains/panicle (170.2).

Different organic nutrient management practices significantly influenced panicle length and panicle weight, whereas their effect on test weight was non-significant. The result revealed that significantly higher panicle length (23.3 cm) was recorded under T_7, which remained statistically at par with T_5 (22.8 cm) and T_1(21.0 cm), while the lower panicle length (18.3 cm) was observed under T_4. Similarly, significantly higher panicle weight (5.33 g) was recorded under T_5 and remained statistically comparable with T_1(5.22 g), T_3 (4.78 g), T_4 (4.56 g) and T_7 (5.11 g), whereas the lower panicle weight (4.05 g) was observed under T_2. No significant differences in test weight were observed among the treatments. Never the less, T_1 recorded the highest test weight (14.1 g), whereas T_6 registered the lowest test weight (12.3 g).

The enhanced yield attributes may be due to the continuous supply of nutrients through organic sources, leading to enhanced nutrient uptake, metabolic activities

Table 2: Effect of different organic nutrient sources on yield attributes and yield of rice.

Treatments	No. of productive tillers/m²	No. of grains /panicle	Panicle length (cm)	Panicle weight (g)	Test weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index (%)
T_1	185.7	218.9	21.0	5.22	14.1	3548.0	5825.2	37.9
T_2	151.6	187.8	18.5	4.05	13.2	3304.3	5132.3	39.2
T_3	148.3	212.9	19.2	4.78	14.0	3453.6	5382.7	39.0
T_4	171.7	201.0	18.3	4.56	12.6	3323.3	5362.3	38.3
T_5	194.6	233.7	22.8	5.33	13.6	4154.3	6084.3	40.6
T_6	158.6	215.4	19.0	4.33	12.3	3486.5	5438.7	39.1
T_7	183.2	220.9	23.3	5.11	13.7	3875.9	6194.0	38.5
T_8	143.9	170.2	18.7	4.06	13.3	2836.1	5715.0	32.9
SEm±	9.5	10.7	0.8	0.30	0.8	198.7	223.7	1.4
CD at 5%	28.7	32.4	2.4	0.92	NS	602.7	678.4	4.2
CV%	9.8	8.9	6.8	11.2	9.7	9.8	6.9	6.2

and overall crop growth. Consequently, better growth and development of the crop resulted in higher yield attributes. The nutrients supplied through organic sources might have stimulated cell division and metabolic activities in meristematic tissues resulting in better vegetative growth of the plant. These findings are in agreement with those reported by Parmar *et al*., (2017), Winarni *et al*., (2016) and Jambhulkar *et al*., (2024).

The effect of different organic nutrient sources on grain yield/hill (g) of rice crop had recorded at harvest. The data graphically depicted in Fig. 1 indicated that different organic nutrient treatments had a significant effect on grain yield/hill of rice at harvest. The results showed that significantly higher grain yield/hill (16.3 g) was recorded with T_5: 80% RDN through NADEP compost + Biochar 2 t/ha + GBF 1250 l/ha + GBF 3% (FS), which was found statistically at par with T_1, T_3, T_4, T_6 and T_7 *i.e.* 15.5, 14.7, 14.2, 14.7 and 15.8 g respectively. The lower grain yield/hill (12.8 g) was recorded under T_8: Ghan-jivamrut 2 t/ha + FYM 2 t/ha + Jivamrut 1250 l/ha + Jivamrut 20% (FS).

Effect of different organic nutrient sources on straw yield/hill graphically illustrated in Fig. 1. The results showed that significantly higher straw yield/hill (33.4 g) was recorded with T_5: 80% RDN through NADEP

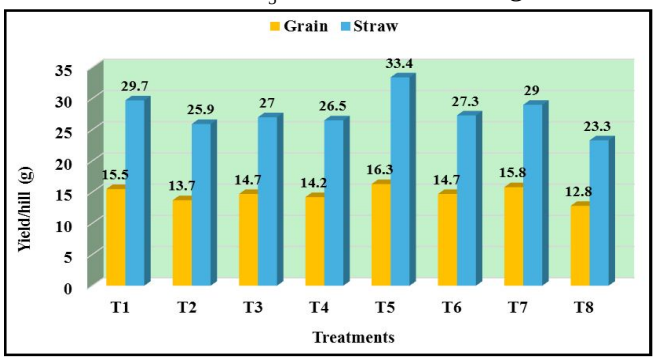


Fig. 1: Effect of different treatments on grain and straw yield/hill of rice.

compost + Biochar @ 2 t/ha + GBF @ 1250 l/ha + GBF 3% foliar spray, which remained statistically at par with T_1 (29.7 g) and T_7 (29.0 g). The lower straw yield/hill (23.3 g) was found under T_8: Ghan-jivamrut @ 2 t/ha + FYM @ 2 t/ha + Jivamrut @ 1250 l/ha + Jivamrut 20% foliar spray.

Grain yield, stover yield and harvest index

The grain yield of rice was significantly influenced by different organic nutrient management practices. Significantly higher grain yield (4154.3 kg/ha) was recorded under T_5 *i.e.* 80% RDN through NADEP compost + biochar @ 2 t/ha + GBF @ 1250 l/ha + GBF 3% foliar spray), which remained statistically at par with T_7 (3875.9 kg/ha). The lower grain yield (2836.1 kg/ha) was observed under T_8 (Ghan-jivamrut @ 2 t/ha + FYM @ 2 t/ha + Jivamrut @ 1250 l/ha + 20% Jivamrut foliar spray).

The increased grain yield may be due to improved nutrient availability, enhanced root growth, greater microbial activity and efficient translocation of photosynthates from source to sink. The gradual release of nutrients from organic sources and improved soil conditions may have promoted better crop growth and productivity. The combined application of biochar and organic amendments might have further enhanced nutrient uptake, moisture retention and microbial activity, resulting in increased yield. These findings are in agreement with those reported by Parmar *et al.*, (2017) Safiullah *et al.*, (2018), Sharma *et al*., (2019), Chen *et al*., (2021) and Raj *et al.*, (2024).

Effect of different organic nutrient sources on straw yield of rice presented in Table 1. The result revealed that significantly higher straw yield (6194.0 kg/ha) was recorded under T_7 *i.e.* 80% RDN through NADEP compost + GBF @ 1250 l/ha + GBF 3% as foliar spray), which remained statistically at par with T_5 (6084.3 kg/ha), T_1(5825.2 kg/ha) and T_8 (5715.0 kg/ha). The lower straw yield (5132.3 kg/ha) was observed under T_2 (80%

RDN through NADEP compost + biochar @ 2 t/ha).

The higher straw yield may be attributed to improved microbial activity and enhanced nutrient availability from organic liquid manures such as jivamrut and *Gliricidia*. This likely promoted better nutrient uptake, carbohydrate synthesis and translocation, resulting in increased vegetative growth and biomass production. Moreover, the improved soil environment under organic inputs may have supported higher metabolic activity and efficient nutrient utilization, ultimately leading to increased straw yield. These results are in accordance with those reported by Sahare and Mahapatra (2015), Patil and Udmale (2016), Parmar *et al.*, (2017) and Raj *et al.* (2024).

The harvest index was significantly influenced by different organic nutrient management practices. Significantly higher harvest index (40.6%) was recorded under T_5, which remained statistically at par with T_1 (37.9%), T_2 (39.2%), T_3 (39.0%), T_4 (38.3%), T_6 (39.1%) and T_7 (38.5%). In contrast, the lower harvest index (32.9%) was observed under T_8.

Conclusion

Based on the results of the experiment, it can be concluded that, for achieving higher growth and yield in rice cv. GNR-7, either soil application of 80% RDN through NADEP compost along with *Gliricidia*-based formulation (GBF) @ 1,250 l/ha at 15, 30 and 45 days after transplanting (DAT) followed by foliar spray of GBF @ 3% at 15, 30 and 45 DAT or application of 80% RDN through NADEP compost alonghwith biochar @ 2t/ha and GBF @ 1,250 l/ha at 15, 30 and 45 DAT followed by foliar spray of GBF @ 3% at 15, 30 and 45 DAT can be practiced under organic farming.

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