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EFFECT OF DIFFERENT NUTRIENT MANAGEMENT SYSTEMS INCLUDING NATURAL FARMING ON GROWTH AND YIELD OF RICE VARIETIES

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ABSTRACT

The influence of various nutrient management practices and rice varieties on the growth and yield parameters of rice were examined by conducting a field experiment during *rabi* season of 2024-25 at ICAR-Indian Institute of Rice Research in Hyderabad. The experiment was designed as a randomized split plot design, having three replications. Four nutrient management treatments were used, H1: 100 percent Organic manure; H2: 50 percent Organic manure 50 percent Inorganic manure; H3: 100 percent Inorganic manure; and H4: Natural farming and three varieties of rice were used; V1: (RNR-15048), V2: (DRR DHAN-55), and V3: (KNM-118). These findings showed that the combined usage of 50 percent organic and 50 percent inorganic manure (H2) had better growth and physiological performance in terms of plant height at harvest (210.5 cm), number of tillers m^{-2} (317.1), dry matter production (561.2 kg ha^{-1}), leaf area (13473.3 cm^2 $hill^{-1}$), SPAD chlorophyll values (45.2 at flowering) and Green seeker values (0.75) at harvest. The treatment also had recorded the highest grain yield (6598.7 kg ha^{-1}), straw yield (7213.3 kg ha^{-1}). Most parameters showed improved performance by the KNM-118 variety (V3), with plant height (119.0 cm), productive tillers (267.1 m^{-2}), dry matter (13473.3 kg ha^{-1}), and leaf area (13473.33 cm^2 $hill^{-1}$), grain yield (7497.7kg ha^{-1}) ,straw yield (8006.0 kg ha^{-1}).

Keywords: Rice varieties, nutrient management, natural farming, integrated nutrient management, growth parameters.

Introduction

Rice (*Oryza sativa* L.) is the staple crop that is consumed by more than half of the world and is also important in food and livelihood security especially in Asia. As one of the major rice producers, India has planted rice to an estimated 44.5 million hectares that produce more than 120 million tonnes of rice every year (Indiastat, 2023). The large scale production is essential in fulfilling food needs both in the country and internationally. But, with the agricultural intensification to supply the increasing population, there has been an increase in the over-dependence on chemical inputs, which have caused poor soil health, a reduction in factor productivity, and environmental degradation (Hunter *et al.*, 2017). Even though the Green revolution was effective in bringing food self-sufficiency in the 1960s and 1970s, it depended on synthetic fertilizer and pesticides, mechanization, and high yield varieties. Although this model was fruitful, it has reached a stumbling point in most rice growing belts and caused long-term depletion of soil nutrients, groundwater pollution, and loss of valuable soil biodiversity, endangering the sustainability of rice production systems (Keating *et al.*, 2014). To overcome these issues, the idea of sustainable agricultural practices has become prominent once again as the possible alternatives to the traditional farming. The three prominent methods, which restore the ecological balance, preserve the soil fertility, and enhance the efficiency of resources use are the Integrated Nutrient Management (INM), Organic Farming (OF), and Natural Farming (NF). The ZBNF developed by Subhash Palekar advocates natural farming which is in balance with the nature without chemical additions, or expensive machinery (Palekar, 2014).

The use of locally accessible materials, especially cow-based inputs, to improve the health of soil and crop resiliency makes ZBNF especially attractive to farmers with limited resources. These chemical-free farming methods include mulching (Acchadana), intercropping, and moisture conservation (Whapasa), which contribute to this mode of farming through improving the microbial biomass of soil, the enzymatic processes, and nutrient cycling and increasing the natural defense mechanism of plants (Kumar *et al*., 2023; Devakumar *et al*., 2014). Genetic and physiological attributes of rice varieties are also important in determining the success of nutrient management strategies as it is a principal determinant of the nutrient uptake efficiency, yield potential and adaptability to environmental stress. It is observed that varieties of rice have great genetic diversity in their adaptation to various nutrient management systems due to the variation in root architecture, nutrient uptake process, translocation efficiency, and stress tolerance ability (Ali *et al*., 2018). Plant varieties with deeper or more prolific root systems would be more efficient in accessing immobile nutrients such as phosphorus and developing positive microbial relationships within the rhizosphere (Wang *et al*., 2024). Moreover, the germination of different genotypes to nutrient transfer to the reproductive organs, chlorophyll and photosynthetic rates were also different under different nutrient regimes, which eventually impacted the yield and quality of the grain (Baruah *et al*., 2023).

Although there is now an emerging interest about the use of natural and integrated nutrient systems, there are no extensive field-based studies to assess the relative performance of a variety of rice under varying nutrient management conditions especially in agro-ecological regions such as Telangana. There is a scarcity of information on the impact of natural farming on soil biological parameters, nutrient absorption, crop quality parameters, and economic parameters in rice systems. The gap in knowledge is addressed in this study, it measures the reaction of the selected rice varieties to the various nutrient management systems i.e., 100% organic, 50% organic + 50% inorganic, 100% inorganic (STCR-based), and natural farming.

Materials and Methods

The field experiment was conducted at Department of Agronomy, ICAR-Indian Institute of Rice Research (IIRR) Farm, Rajendranagar, Hyderabad during *Rabi* season 2024-25, located at an altitude of 542.3 meters above mean sea level, at 17°19' N latitude and 78°23' E longitude. This site falls under the Southern Telangana agro-climatic zone and represents the semi-arid tropics (SAT) according to Troll's climatic classification. The weather conditions were favourable for optimal growth and development during the crop growth period. The weekly mean maximum temperature ranged from 23.0°C to 39.0°C, averaging 31.2°C, while the weekly mean minimum temperature varied between 8.5°C and 23°C, with an average of 16.3°C. The daily mean bright sunshine hours ranged from 0.2 to 10.2 hours, averaging 7.47 hours, the average rainfall was 4.8mm, and the daily mean evaporation was 4.86 mm.

The experiment was carried out on clay loamy soils, which were medium in organic carbon and nutrient content, with soil pH of 7.48, electrical conductivity of 0.52 dS m^{-1}, available nitrogen 214 kg ha^{-1}, available phosphorus 47 kg ha^{-1}, and available potassium 313 kg ha^{-1}. Three popular rice varieties RNR 15048 (V1), DRR DHAN-55 (V2), and KNM-118 (V3) were selected for the study. High-quality seeds of each variety were soaked for 24 hours and incubated in a moist gunny bag for sprouting. The sprouted seeds were sown on a well-prepared field.

The experiment was laid out in a strip plot design, with four horizontal strips representing different nutrient management practices and three vertical strips representing the rice varieties. Each treatment was replicated thrice. The horizontal strip treatments included were H1: 100% Organic manure, H2: 50% Organic + 50% Inorganic manure, H3: 100% Inorganic manure, H4: Natural farming and vertical strips included were V1: RNR-15048, V2: DRR DHAN-55, V3: KNM-118.

In H1, the equivalent nitrogen requirement was supplied entirely through organic manures, including green manures, farmyard manure (FYM), vermicompost, and biofertilizers. H2 received 50% nitrogen through the same organic sources and the remaining 50% through urea, while phosphorus and potassium doses were adjusted using single super phosphate (SSP) and muriate of potash (MOP), respectively, after accounting for the phosphorus content in the organic manures. In H3, based on soil test crop response (STCR) recommendations, 100% nitrogen was applied through urea, and phosphorus and potassium were supplied through SSP and MOP, respectively, with urea applied both as basal and top dressing. H4 followed natural farming practices, which included raising a green manure crop (Dhaincha) before the rabi crop, seed treatment with Beejamrutham (BJM) at 5 L per 25–30 kg of seed, and the application of Ghanajeevamrutham (GJM) at 1000–1500 kg ha^{-1} during the last ploughing/puddling and 400 kg $acre^{-1}$ in two equal splits at 20 and 40 days after transplanting (DAT). Dravajeevamrutham (DJM) was applied as a soil drench at 800 L $acre^{-1}$ in four splits at 35, 50, 65, and 80 DAT (200 L each) and as a foliar spray at 15, 20, 25, and 30 L in 100 L of water at the respective stages. Growth promoters, including Molakala Dravanam and Matti Dravanam, were applied at the milking and grain-filling stages, and sour buttermilk was sprayed during flowering. Pest management under H4 was carried out through the foliar application of Neemastram and Agnastram. All other agronomic practices, including irrigation, weed management, and intercultural operations, were uniformly maintained across all experimental plots.

Growth parameters such as plant height, tiller number, dry matter production, and leaf area, SPAD meter and green seeker readings were recorded at active tillering, panicle initiation, flowering and harvest stages along with yield and harvest index (HI). The data obtained was subjected to analysis of variance (ANOVA) appropriate for strip plot design, and treatment means were compared using Tukey's HSD test at $p \leq 0.05$. Interaction effects between horizontal (nutrient management) and vertical (varieties) strips were also analyzed to determine combined effects on growth parameters.

Results and Discussion

Plant Height (cm)

One of the major growth indicators of a plant is the height of the plant. H2 (50 percent Organic + 50 percent Inorganic manure) had the tallest plant of all growth stages as it grew up to 210.6 cm during the harvest (Table 1). It was followed by H3 (100% Inorganic manure) with 202.4 cm and H1 (100% Organic manure) with 192.4 cm and the lowest plants were documented under H4 (Natural farming) with 185.6 cm. DRR DHAN-55 (V2) had the largest height at harvest (123.9 cm), KNM-118 (V3) at 119.0 cm and RNR-15048 (V1) at 118.4 cm. This increased height of plants in the higher level of the Organic + 50 percentage of Inorganic manure treatment may be due to the synergistic effects of the organic and inorganic nutrients to improve soil structure and microbial activity and inorganic fertilizers to provide nutrients readily available that in combination led to cell division and elongation (Iqbal *et al.*, 2022). Increased nutrient supply facilitates cell division and lengthening leading to strong stem growth. Conversely, natural farming may constrain the supply of nutrients, which limits the growth of vegetation and the height of plant (Srisawat *et al.*2024). The tallest plant at harvest was observed in KNM-118 (V3), which may be due to the genetic ability to grow vigorously in terms of vegetation and effectively absorb nutrients.

Number of tillers (m^{-2})

The number of tillers (m^{-2}) is a relevant determinant of rice productivity because it is a measure of the ability of the plant to produce productive panicles. Under 50% Organic + 50% Inorganic manure, highest number of tillers were observed at tillering (372.4 m^{-2}), panicle initiation (322.1 m^{-2}), flowering (317.1 m^{-2}), and harvest stages (Table 1). Total organic and inorganic treatment had relatively lower tillers and natural farming had the lowest numbers of tillers in all stages. The highest number of tillers was obtained in RNR-15048 (V1) (386.9 m^{-2} at tillering), then DRR DHAN-55 (V2) and KNM-118 (V3). The productive tiller number (309.4 m^{-2}) was found to be maximum in RNR-15048, which could be due to genetic tendency towards tiller growth and high vegetation development. The better tillering with 50% Organic + 50% Inorganic manure treatment implies that the integrated nutrient management helps initiating and maintaining the tillers, which is probably because of the better availability of nitrogen and increased vegetative activity (Bhardwaj *et al.*, 2023). Proper nutrition at the initial growth phases maintains active tillers and their transformation into productive panicles, which may directly have a direct effect on the yield of grains (Allam *et al.*, 2022). The reduced number of tillers with natural farming implies that there may be nutrient shortages during the initiation and maintainance of tillers (Srisawat *et al.*, 2024).

Dry matter accumulation (kg ha^{-1})

A significant indicator of biomass accumulation and general efficiency of the growth of the plant is dry matter production (kg ha^{-1}). H2 (50% Organic + 50% Inorganic manure) was the nutrient management method that showed the highest DM production at all the growth stages with the highest average of 12,642.1 kg ha^{-1} at flowering stage and 561.2 kg ha^{-1} at harvest (Table 2). H3 (100% Inorganic manure) and 12,485.1 kg ha^{-1} at flowering were close and the biomass of H1 (100% Organic manure) and H4 (Natural farming) was lower (Table 2). KNM-118 (V3) recorded the highest dry matter (13,473.3 kg ha^{-1} at harvest) followed by RNR-15048 (V1) and DRR DHAN-55 (V2). KNM-118 (V3) had the greatest dry matter since it possesses the best leaf area and highest photosynthetic machinery, whereas DRR DHAN-55 had the lowest because of its reasonably good growth rate. The complementary effect of the organic and inorganic sources of nutrients probably explains the increased biomass under the condition of 50% of the Organic + 50% Inorganic manure treatment, which increase the availability of nutrients and effectiveness of nutrient uptake during vegetative and reproductive phases (Ashrafi *et al.*, 2019). Sufficient nutrient supply particularly nitrogen and phosphorus would enhance photosynthesis, carbohydrate storage, and structural development, which increases dry matter production. Lower dry matter production in natural farming represents possible deficiency of nutrients limiting biomass buildup (Moe *et al*. 2017).

Leaf area (cm^2 $hill^{-1}$)

The physiological parameter that is of significance is the Leaf area (cm^2 $hill^{-1}$) due to the capacity of the plant to intercept light and carry out photosynthesis. Similarly, organic and inorganic manure treatment H3 (876.2 cm^2 $hill^{-1}$) and H1 (865.6 cm^2 $hill^{-1}$) had the highest values at flowering of 896.1 cm^2 $hill^{-1}$), compared to the Natural farming which had the lowest of 860.4 cm^2 $hill^{-1}$ (Table 2). KNM-118 (V3) was shown to have the greatest leaf area (13,473.3 cm^2 $hill^{-1}$ at harvest) suggesting better vegetative vigor and possible increased photosynthate production. The increased leaf area under the integrated nutrient management is probable owing to the improved supply of nutrients that promote the division and the growth of the leaf tissues. An increase in the leaf area enhances the light capture and photosynthetic efficiency, which has a direct effect in terms of increase in dry matter accumulation and eventually yield (Kushwah *et al.*, 2024; Golla, 2020). Less vegetative development suggests lower vegetative cover as shown by reduced leaf area in natural farming, perhaps because of the low availability of nutrients at the critical growth stages (Bana *et al.*, 2022).

SPAD meter readings

The readings of the SPAD meter give a quick, non-destructive determination of the chlorophyll on the leaf that is related to the nitrogen status of the plant. H2 (50% Organic and 50% Inorganic manure) had the largest SPAD values across all stages of growth, with the highest being 45.2 at flowering, followed by H3 (100% Inorganic manure, 44.4), and H1 (100% Organic manure, 43.3), whereas H4 (Natural farming) had the lowest values (43.4) (Table 3). The increased SPAD values under integrated nutrient management implies the availability of more nitrogen and the increase in chlorophyll production, which results in high photosynthesis. RNR-15048 (V1) and KNM-118 (V3) showed a slightly higher SPAD value at later stages (44.4 and 44.4 at harvest, respectively) than DRR DHAN-55 (V2, 43.4), indicating that they had different varietal uptakes of nitrogen and chlorophyll. KNM-118 had higher values of SPAD indicating it possessed higher capability of nitrogen assimilation and retention of chlorophyll that promotes greater photosynthesis and growth. The results emphasize that the optimal use of organic and inorganic sources of nutrients may be used to achieve the maximum level of leaf greenness and photosynthetic potential, which is essential to assimilate production and yield formation (Kumar *et al*. 2025).

Green Seeker readings

The readings of Green Seeker are used to determine the normalized difference vegetation index (NDVI), which reflects the crop vitality, leaf area, and the biomass development (Saishree *et al.*, 2023). The highest values of NDVI were also observed under H2 (0.75 during harvest), followed by H3 (0.71), and H1 (0.70), and H4 (0.69) the lowest (Table 3). This tendency is similar to SPAD measures showing that the balanced intake of nutrients promotes the increased canopy greenness and development of leaf areas. KNM-118(V3) and RNR-15048(V1) possessed better values at harvest (0.72 and 0.71, respectively), whereas DRR DHAN-55(V2) had slightly lower values (0.71). Greater NDVI implies more vigor and biomass of crops and photosynthesis, meaning that integrated nutrient management boosts growth and may lead to higher yield due to a better capacity to intercept and assimilate radiation (Wang *et al.*, 2020; Hnizil *et al.*, 2024). The increased green seeker readings of KNM-118 may indicate that it possesses the capacity to assimilate and retain chlorophyll which would facilitate higher photosynthetic capability and growth.

Grain yield (kg ha^{-1})

The grain yield is a result of the productive tillers, the traits of panicles, and grain filling efficiency (Zhao *et al.*, 2020; Zhou *et al.*, 2022). H2 had the highest grain yield (6598.7 kg ha^{-1}) then H3 (6463 kg ha^{-1}) and H1 (6372.7 kg ha^{-1}) (Fig. 3). H4 had the lowest (6287.2 kg ha^{-1}) grain yield. This trend shows that the balanced supply of nutrients under integrated nutrient management improves assimilate production and partitioning to grain formation. KNM-118 (V3) was found to yield better grain (up to 7497.7 kg ha^{-1}), then RNR-15048 (V1), and DRR Dhan-55 (V2) (Fig. 4). KNM-118 yielded higher indicates the superiority of this variety in terms of reproductive efficiency, spikelet fertility, and biomass-to-grain conversion, whereas in the case of DRR Dhan-55 yield may be low due the low survival rate of the tillers and ability to fill the spikelet's (Zhao *et al*., 2020).

Straw yield (kg ha^{-1})

Straw yield, which is a measure of vegetative vigor and biomass accretion also exhibiting the same pattern as grain yield. H2 showed the highest yield of straw (7213.3 kg ha^{-1}) where as H4 was the lowest (6802.7 kg ha^{-1}) (Table 4). These findings emphasize how a balanced availability of nutrients can aid in promoting higher tillering and higher leaf area growth and enhanced photosynthesis. KNM-118 (V3) was superior in terms of the straw yield (topping at 8006.00 kg ha^{-1}). Increased vegetative biomass in KNM-118 is an indication of more robust growth and canopy compared to the relatively low biomass of DRR Dhan-55 caused by a lower number of tillers and the leaf area index (Jian *et al*. 2022; Marzouk *et al*., 2024).

Harvest Index (%)

The efficiency of total biomass to economic yield is known as Harvest Index (HI), and had a relatively small range of differences among establishment methods. The range of HI was between 47.7% and 48.1% with H4 registering the highest (48.1%) and H1 registering next (48.1) (Table 4). Varieties on the contrary had more difference, V2 had the highest HI (48.4%), followed by V3 (48.3%) and V1 had a relatively low HI (47.1%) (Fig. 3). The higher HI of V2 and V3 indicates that channeling assimilates in the grain production and V1 had more biomass in the vegetative constituents. These findings indicate that genetic factors have a greater influence than establishment method on partitioning efficiency, which aligns with the findings that varietal traits have a major influence on the expression of harvest index (Kumar *et al*. 2025).

Conclusion

The present experiment shows that methods of nutrient management and varietal difference have a great impact on the growth, development, physiological state, and yield of rice. The integrated method of H2 (50% organic and 50% inorganic manure) was found to enhance the plant height, dry matter accumulation, leaf area, SPAD and Green Seeker measurements, number of productive tillers, days to maturity and had higher grain yield, straw yield and harvest index. Organic-only (H1) and natural farming (H4) treatments had relatively smaller values in most of the growth and physiological parameters. KNM-118 (V3) had better performance in the form of plant height, dry matter, leaf area, chlorophyll content, productive tillers and yield as compared to RNR-15048 (V1) and DRR DHAN-55 (V2). These findings, suggest that incorporating balanced organic and inorganic nutrients along with high-yielding varieties can result in maximum growth, physiological efficiency, and yield potential in the rice cultivation

Table 1: Plant height (cm), number of tillers m^{-2} at Tillering and Panicle initiation, flowering and at harvest stages of different rice varieties as influenced by different nutrient management methods

Nutrient management methods	Plant height (cm)				Number of Tillers m^{-2}			
	At Tillering	At Panicle initiation	At Flowering	At Harvest	At Tillering	At Panicle initiation	At Flowering	At Harvest
H1 (100% Organic manure)	37.6	76.8	105.3	120.2	192.4	352.0	311.2	307.8
H2 (50% Organic + 50% Inorganic manure)	39.0	77.9	106.7	121.5	210.5	372.4	322.1	317.1
H3 (100% Inorganic manure)	38.1	77.4	105.8	120.7	202.4	356.4	300.1	295.4
H4 (Natural farming)	36.8	76.0	104.4	119.3	185.5	348.3	297.8	292.7
SEm (±)	1.4	1.7	2.0	2.8	6.0	8.0	7.0	6.0
CD (P=0.05)	0.6	0.7	0.8	0.7	2.2	1.4	1.9	0.9
Varieties								
V1 (RNR-15048)	31.6	70.4	102.4	118.4	203.6	386.9	314.5	309.4
V2 (DRR DHAN-55)	39.2	79.8	105.4	123.9	193.5	345.0	306.0	301.3
V3 (KNM-118)	42.8	80.8	108.8	119.0	196.2	340.0	302.9	299.0
SEm (±)	1.2	2.5	2.3	2.6	9.0	7.0	6.0	6.0
CD (P=0.05)	1.0	0.7	0.5	0.7	1.8	1.1	0.9	1.2
Interaction effect								
Main plot at same level of sub								
CD (P=0.05)	NS	NS	NS	NS	2.8	2.9	2.3	1.4
Sub at same level of main								
CD (P=0.05)	NS	NS	NS	NS	2.6	3.0	1.7	1.6

Horizontal strip treatments: H1- 00% Organic manure (Green manure + FYM + Vermicompost + Biofertilizer), H2-50% Organic + 50% Inorganic manure, H3-100% Inorganic manure, H4-Natural farming
Vertical strip treatments: V1-RNR – 15048, V2-DRR DHAN – 55, V3: KNM 118

Table 2: Dry matter production (kg ha^{-1}), Leaf area (cm^2 $hill^{-1}$) at Tillering and Panicle initiation, flowering and at harvest stages of different rice varieties as influenced by different nutrient management methods.

Nutrient management methods	Dry matter production (kg ha^{-1})				Leaf area (cm^2 $hill^{-1}$)			
	At Tillering	At Panicle initiation	At Flowering	At Harvest	At Tillering	At Panicle initiation	At Flowering	At Harvest
H1 (100% Organic manure)	2178.1	7412.0	10412.8	12330.3	524.2	865.6	10412.8	12330.3
H2 (50% Organic + 50% Inorganic manure)	2355.9	7694.3	10968.7	12642.1	561.2	896.1	10968.7	12642.1
H3 (100% Inorganic manure)	2252.2	7579.4	10568.9	12485.1	542.4	876.2	10568.9	12485.1
H4 (Natural farming)	2102.7	7399.0	10326.9	12262.8	520.9	860.4	10326.9	12262.8
SEm (±)	85.0	125.0	153.0	185.0	15.0	19.0	153.0	185.0
CD (P=0.05)	2.1	2.7	2.6	1.0	0.2	0.6	2.6	1.0
Varieties								
V1 (RNR-15048)	2139.5	7203.3	10141.3	12137.2	520.3	862.0	10141.3	12137.2
V2 (DRR DHAN-55)	1909.8	6784.2	9347.7	11679.7	507.3	849.7	9347.7	11679.7
V3 (KNM-118)	2617.3	8576.0	12218.9	13473.3	545.0	885.0	12218.9	13473.3
SEm (±)	76.0	127.0	165.0	175.0	17.0	21.0	165.0	175.0
CD (P=0.05)	5.2	2.2	2.4	4.3	0.6	0.4	2.4	4.3
Interaction effect								
Main plot at same level of sub								
CD (P=0.05)	2.6	4.5	3.5	3.3	0.6	0.8	3.5	3.3
Sub at same level of main								
CD (P=0.05)	5.5	4.4	3.4	5.5	0.9	0.6	3.4	5.5

Horizontal strip treatments: H1- 00% Organic manure (Green manure + FYM + Vermicompost + Biofertilizer), H2-50% Organic + 50% Inorganic manure, H3-100% Inorganic manure, H4-Natural farming
Vertical strip treatments: V1-RNR – 15048, V2-DRR DHAN – 55, V3: KNM 118

Table 3: SPAD meter, Green Seeker readings at Tillering and Panicle initiation, flowering and at harvest stages of different rice varieties as influenced by different nutrient management methods

Nutrient management methods	SPAD meter readings				Green Seeker readings			
	At Tillering	At Panicle initiation	At Flowering	At Harvest	At Tillering	At Panicle initiation	At Flowering	At Harvest
H1 (100% Organic manure)	40.2	40.8	42.7	43.3	0.64	0.66	0.67	0.70
H2 (50% Organic + 50% Inorganic manure)	40.8	42.5	44.4	45.2	0.70	0.73	0.74	0.75
H3 (100% Inorganic manure)	40.8	42.0	43.7	44.4	0.66	0.67	0.69	0.71
H4 (Natural farming)	40.3	41.0	42.3	43.4	0.64	0.66	0.68	0.69
SEm (±)	0.6	0.8	1.1	1.3	0.02	0.02	0.05	0.07
CD (P=0.05)	0.3	0.1	0.1	0.2	0.01	0.01	0.01	0.01
Varieties								
V1 (RNR-15048)	40.4	41.4	43.9	44.4	0.67	0.68	0.70	0.71
V2 (DRR DHAN-55)	40.4	41.7	42.5	43.4	0.65	0.67	0.69	0.71
V3 (KNM-118)	40.7	41.6	43.4	44.4	0.67	0.69	0.70	0.72
SEm (±)	1.3	1.4	1.2	1.5	0.04	0.02	4.00	5.00
CD (P=0.05)	NS	0.1	0.1	0.2	0.01	0.02	0.03	0.02
Interaction effect								
Main plot at same level of sub								
CD (P=0.05)	0.44	NS	0.08	0.30	0.04	0.03	0.05	0.06
Sub at same level of main								
CD (P=0.05)	0.60	NS	0.09	0.35	0.04	0.03	0.06	0.07

Horizontal strip treatments: H1- 00% Organic manure (Green manure + FYM + Vermicompost + Biofertilizer), H2-50% Organic + 50% Inorganic manure, H3-100% Inorganic manure, H4-Natural farming
Vertical strip treatments: V1-RNR – 15048, V2-DRR DHAN – 55, V3: KNM 118

Table 4: Straw yield and Harvest index of different rice varieties as influenced by different nutrient management methods

Nutrient management methods	Grain yield (kg ha^{-1})	Straw Yield (kg ha^{-1})	Harvest Index (%)
H1 (100% Organic manure)	6372.7	6879.7	48.1
H2 (50% Organic + 50% Inorganic manure)	6598.7	7213.3	47.7
H3 (100% Inorganic manure)	6463	7034.3	47.9
H4 (Natural farming)	6287.2	6802.7	48.1
SEm (±)	102	123.0	0.4
CD (P=0.05)	1.5	2.7	1.1
	Varieties		
V1 (RNR-15048)	6570.8	7351.8	47.1
V2 (DRR DHAN-55)	5240.8	5589.8	48.4
V3 (KNM-118)	7497.7	8006.0	48.4
SEm (±)	99.0	135.0	0.4
CD (P=0.05)	4.2	5.3	1.0
	Interaction effect		
	Main plot at same level of sub		
CD (P=0.05)	3.0	3.7	NS
	Sub at same level of main		
CD (P=0.05)	5.0	5.9	NS

Horizontal strip treatments: H1- 00% Organic manure (Green manure + FYM + Vermicompost + Bio fertilizers), H2-50% Organic + 50% Inorganic manure, H3-100% Inorganic manure, H4-Natural farming
Vertical strip treatments: V1-RNR – 15048, V2-DRR DHAN – 55, V3: KNM 118

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