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Effect of different fertilizer management practices on growth, yield, and yield attributing characters of transplanted rice (*Oryza sativa* L.) in Morang Districts of Nepal

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Abstract

Rice (*Oryza sativa* L.) is edible starchy cereal grain which is economically and culturally most important food crop and regarded as world's 3rd crop on the basis of volume of production. Transplanted rice involves pulling up of 20-25 old seedling of rice from nursery bed to puddled main fields for better crop establishment and weed control. The field work was conducted from 2nd week of June to 1st week of December at the research field of G. P. Koirala College of Agriculture and Research Centre (GPCAR), Gothgaun, Morang, using the late-maturing tall rice cultivars Lalka basmati. The field trial was performed in Randomized Complete Block Design (RCBD) having ten treatments including control with each treatment replicated for 3 times. Data was analysis using excel, and rstudio. Pearson correlation coefficient of the various variable was determined. Nitrogen fertilizer application significantly influenced the growth, tillers, yield and yield attributing characters of transplanted rice. The highest plant height and number of tillers per hills was recorded from the 'T6' treated plot with nitrogen (N) was double than that of the recommended dose of fertilizer for our locality. Yield-attributing characters such as panicle length (25.27cm) and number of grains per panicle (145.33) were highest in 'T6', while thousand grain weight was maximum in 'T4' (17.45gm) and sterility percentage was lowest in 'T4' (43.69%). Grain yield ranges from 1.54 mt/ha in 'T1' to 6.08 mt/ha in 'T4'. Similarly, straw yield ranges from 6.84 mt/ha in 'T1' to 12.43 mt/ha in 'T4'. Higher nitrogen level improved growth, panicle length and number of grains per panicle but fails to improve the grain yield, straw yield and harvest index due to sudden change in climate and lodging.

Keywords: Panicle, Thousand Grain Weight (TGW), sterility percent, and tillers

1. Introduction

Rice (*Oryza sativa* L.) is one of the most important staple food crops belongs to the Poaceae family. In Nepal 61.76% workforce heavily reliant on the agriculture. Rice is world most adaptable crop which can be grown in desert, slash and burn forest altitude ranging from 3 meter below sea level to 3000-meter-high Mountains in large quantity and imported to meet the food nutrition demand of the population. The Agriculture Development Strategy (ADS) of the Government of Nepal (GON) has also given top priority to rice for ensuring food security and enhancing economic growth. In the rice cultivation areas rate of fertilizer application is lower than that recommended by the government which leads to the lower yields (3.3t/ha) despite the favorable land and environment condition has the potential yields (above 5t/ha). The large yield gaps exist between attainable yields and farmer's yields, i

improper fertilizer management has been identified as a major factor contributing to low productivity (Amgain *et al.*, 2021) [3].

Transplanted rice is the widely practiced rice cultivation method in Southeast Asia. This system involves transplanting 22-25 old seedling of rice from nursery bed to puddled main Fields for better crop establishment and weed control. However, transplanted rice requires substantial nutrients inputs to sustain high yield as the rice plants remove significant quantities of nutrients from soil during its growth stage. Studies have shown that to produce 1Mg of rice grain, nutrients requirement was approximately 2.01kg, 0.44kg, and 3.06kg of N, P, and K respectively (Singh *et al.*, 2021) [12].

Several field trials have been conducted to evaluate the response of transplanted rice at different fertilizer levels and nutrients management. Studies on fertilizer trials shown that plot with high nitrogenous application i.e. 180kg/ha has results higher plant height, the number of tillers, effective tillers, filled grain per panicle, panicle length, grain yield and straw yield (Giri *et al.*, 2022) [7]. In chaite-5 paddy variety plot with doubled dose of RDF (200: 60: 60 kg NPK/ha) showed the largest plant height, number of tillers per hills, large panicle length, thousand grain weight, grain yield, and straw yield (Adhikari *et al.*, 2021) [2]. In Kavre district of Nepal, yield attributing characters of rice i.e. effective tillers per meter square, panicle length, filled grains per panicle, and test weight were higher in plot treated with chemical fertilizer (Kandel *et al.*, 2018) [11]. Plant height, number of tillers per meter square, panicles per meter square, yield and agronomic efficiency were recorded higher under FDP, 120% RDN + 100% P and K + ZnSO₄ @10 kg/ ha + biofertilizer (Das *et al.*, 2024). Plot treated with chicken manure 2.5 t/ha and 50% CFRR (Chemical

fertilizer Recommended Rate) have shown higher plant height, number of tillers per plant, straw yield, number of panicles per plant, number of filled grains per panicle, thousand grain weight, and nutrient content (%N, %P, and K) on grains and straw (Anisuzzaman *et al.*, 2021) [4].

2. Methodology

2.1 Experimental site

This research work was conducted on the experimental field of the G.P. Koirala College of Agricultural and Research Center (GPCAR), Gothgaun, Morang from 8th of June 2025. The climate of this experimental field was tropical and the altitude ranges from 61 to 83 meters. The average annual temperature lies between 22.81 to 32.46° C.

2.2 Soil properties of experimental field

Soil from the experimental field was taken and measured using aquasol soil box. The soil test shows the following results shown in the table no.1.

Table 1: with soil test reports

Soil test	Results
pH	6.5
Nitrogen (N)	20kg/ha
Phosphorus (P)	<25kg/ha
Potassium (K)	>400kg/ha
Organic Carbon (OC %)	0.8-1%

2.3 Experimental Design

The field trial was performed in Randomized Complete Block Design (RCBD) having ten treatments including control with each treatment replicated for 3 times shown in table no.

Table 2: shows the treatments details

S.N/T	Treatments
T1	0:0:0 NP ₂ O ₅ K ₂ O kg/ha
T2	0: 40:50 kg NP ₂ O ₅ K ₂ O/ha, apply SSP for P ₂ O ₅
T3	60:40:50 NP ₂ O ₅ K ₂ O kg/ha (N top dress at tillering and panicle initiation stages) + 3 kg ZnSO ₄ + 1 kg/ha Borax
T4	120:40:50 NP ₂ O ₅ K ₂ O kg/ha+3 kg ZnSO ₄ (N top dress at tillering and panicle initiation stages) + 1 kg/ha Borax (GON recommendation)
T5	180:40:50 NP ₂ O ₅ K ₂ O kg/ha+3 kg ZnSO ₄ (N top dress at tillering and panicle initiation stages) + 1 kg/ha Borax
T6	240:40:50 NP ₂ O ₅ K ₂ O kg/ha+3 kg ZnSO ₄ (N top dress applied at tillering and panicle initiation stages) + 1 kg/ha Borax
T7	120:40:50 kg NP ₂ O ₅ K ₂ O kg/ha +3 kg ZnSO ₄ (N top dress using LCC) + 1 kg/ha Borax N top dress applied at tillering and panicle initiation stages+ 1 kg/ha Borax
T8	78:40:50 kg NP ₂ O ₅ K ₂ O kg/ha, N from UDP at the tillering stage + 3kg Znso ₄ + 1kg/ha Borax
T9	78:40:50 kg NP ₂ O ₅ K ₂ O/ha, N application using polymer coated urea (PCU) + 3 kg ZnSO ₄ + Borax 1 kg/ha
T10	120:0:50 NP ₂ O ₅ K ₂ O kg/ha+3 kg ZnSO ₄ N top dress applied at tillering and panicle initiation stages+ 1 kg/ha Borax

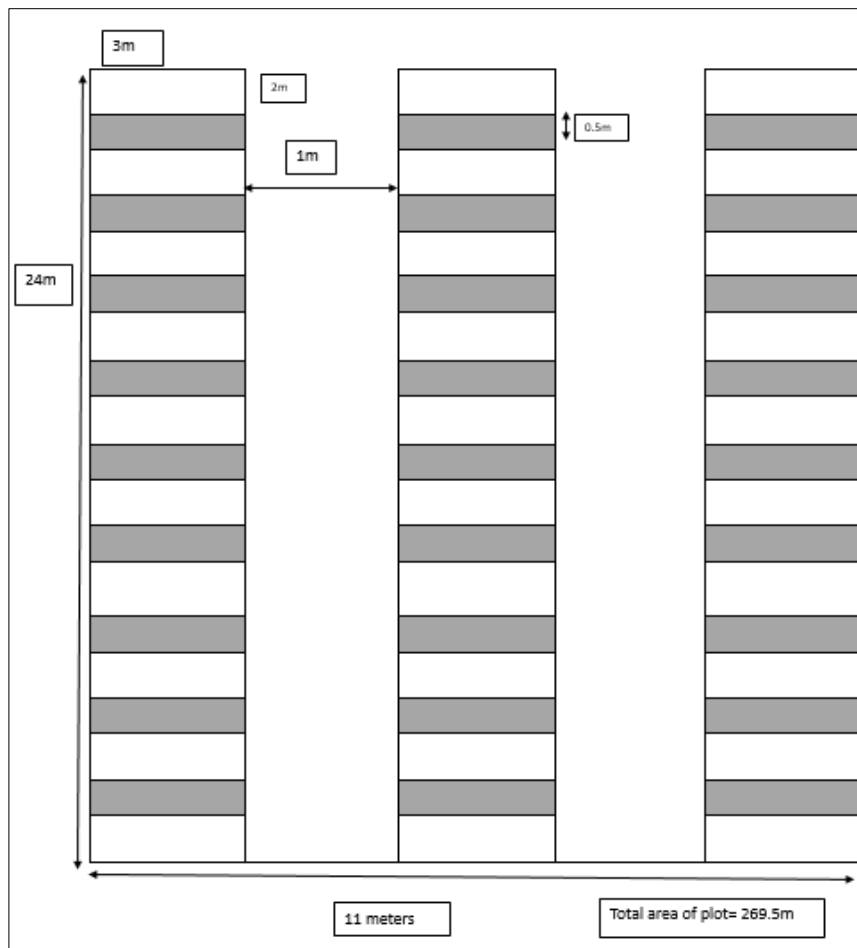


Fig 1: Layout of Experimental Field Showing Treatment Arrangement under RCBD Design

2.4 Planting materials

Tall rice cultivar Lalka Basmati was taken from Nepal Agricultural Research Council (NARC), Tarahara.

2.5 Cultivation practices

2.5.1 Nursery preparation

Wet nursery beds of 20m² with 2kg seeds were used to grow the rice seedling for transplanting in 180m². The bed had a fine tilth by 2-3 ploughing and was levelled. Rice seeds were soaked in water for 24 hours and inside the jute sacks for 8 hours. After that the seed was kept in shade with stirring for air circulation until sprouting. The sprouted seed was broadcasted in wet bed. For the first few days, the field was kept saturated, and then the water level was increased to 5cm. A drainage channel of 30cm was constructed at the border of nursery bed. After 10 days of seed sowing, 200gm of urea was broadcasted. Within 22 days, the seedlings were transplanted in the main field.

2.5.2 Land preparation

The land was ploughed with a mouldboard plough 2-3 times until a fine tilth was achieved. Since FYM was applied, it was spread just prior to seedling transplanting and incorporated immediately into the soil.

2.5.3 Fertilizer management

All the necessary fertilizer along with 6kg of well-decomposed FYM was broadcasted in the seedling transplanting field. Nitrogen (N) was applied in 3 splitting doses equally at land preparation, at tillering, and panicle initiation. In the treatment where N was applied based on Leaf Color Chart (LCC), 1/3rd of the N was applied at the land preparation and then based on LCC at 120 kg N basis for each application. The fertilizer was broadcasted

uniformly over the soil surface. For all PCU and UDP plots N were applied at planting.

2.5.4 Planting distance and Transplanting time

The rice seedlings were transplanted in the 30th of June. The planting distance was maintained at 20 × 20 cm with 2 seedlings per hill.

2.5.5 Gap filling

A portion of the seedlings was kept at a site in the field to replace damaged hills caused by insects, pests, diseases, or other factors during the establishment period.

2.5.6 Water management

Water was maintained at a depth of 2cm up to panicle initiation and at 5cm thereafter until one week before harvest.

2.5.7 Weed control

Only one hand weeding was practiced at the 30 days of transplanting.

2.5.8 Harvesting

The crop after reaching maturity (grain moisture 15-20%) was harvested, excluding a 50cm border.

2.6 Observation recorded

The following data related to crop growth and yield parameters was recorded.

2.6.1 Plant height

From each plot ten hills were chosen randomly and their height was measured. The initial measurement was taken at 30 Days after Transplanting (DAT), with subsequent taken

at every 15 days thereafter. Height was measured from the base to the tip of the panicle during reproductive growth.

2.6.2 Number of tillers per hill

The number of tillers per hill was counted initially at 30DAT and subsequently at 15 days intervals.

2.6.3 Yield attributing characters

2.6.3.1 Length of panicle

Measurement of the panicle length was taken from the base to the tip of panicles from five different tillers of different hills from the net plot area of each plot.

2.6.3.2 Number of grains per panicle

Five panicles from different hills of net plot area were randomly harvested and counted. Filled and unfilled grains were counted separately, and the respective value was averaged.

2.6.3.3 Sterility percent

Sterility percent was calculated as:

$$\text{Sterility Percent} = \frac{\text{Number of unfilled grain per panicle}}{\text{Total number of grains per panicle}} \times 100$$

2.6.3.4 Thousand Grain Weight (TGW)

Thousand grains were collected from each plot and weighted with the help of an electronic balance, and the weight was converted into grams.

2.7 Yield

2.7.1 Grain yield

After harvesting, the crop was threshed and sun-dried for 3 days, and grain yield was recorded from the net plot area in kilogram (kg) using a digital weighing balance.

2.7.2 Straw yield

At the time of harvesting, straw obtained from the net plot area was weighed and recorded in kilogram (kg) using a digital weighing balance.

2.7.3 Biological yield

Grain and straw yield obtained from the net plot area were added to determine the biological yield from each treatment.

2.7.4 Harvest index (HI)

The harvest index was calculated using the following formula:

$$HI = \frac{\text{Economic Yield}}{\text{Biological Yield}}$$

2.8 Data Entry and Analysis

Data was entered into the excel sheet and analysis using Rstudio. Pearson correlation coefficient of the various variable was determined using R.

3. Results and Discussion

3.1 Plant height

This study shows that plant height was significantly influenced by various doses of nitrogen (N) application. The average plant height was 69cm, 98.15cm, 106.11cm, 123.49cm, 136.85cm and 143.79 cm at 30DAT, 45DAT, 60DAT, 75DAT, 90DAT, and 105DAT respectively. Plot treated with 'T6' (240:40:50 NP2O5K2O kg/ha+3 kg ZnSO4 (N top dress applied at tillering and panicle initiation stages) + 1 kg/ha Borax) shows the tallest plant height at every dates i.e. 118.60cm, and 127.20cm at 45DAT, and 60DAT. At 75DAT from 'T6' i.e. 147.13cm and 'T10' (120:0:50 NP2O5K2O kg/ha+3 kg ZnSO4 N top dress applied at tillering and panicle initiation stages+ 1 kg/ha Borax) i.e. 132.26cm. At 90DAT and 105DAT 'T6' and 'T5' (180:40:50 NP2O5K2O kg/ha+3 kg ZnSO4 (N top dress at tillering and panicle initiation stages) + 1 kg/ha Borax) shows the tallest plant height 161cm and 150.16cm and 167cm and 157.10cm respectively. Shortest height was recorded from T1 (0:0:0 NP₂O₅K₂O kg/ha) i.e. 77.60cm, 84.36cm, 98.06cm, 104.26cm, and 111.46cm at 45DAT, 60DAT, 75DAT, 90DAT, and 105DAT respectively. At 30DAT the plant height was not significantly influenced by various dose of N application shown in table no.3. The highest plant height was recorded where N was applied at 205 kg ha⁻¹ while the lowest was measured at 100 kg ha⁻¹ nitrogen application rate (Abid *et al.*, 2015) ^[1].

Table 3: Plant height influenced by various dose of N application practices at Sundarharicha-7, Morang

Treatments	30DAT (cm)	45DAT (cm)	60DAT (cm)	75DAT (cm)	90DAT (cm)	105DAT (cm)
T1	59.76	77.60 ^d	84.36 ^d	98.06 ^c	104.26 ^c	111.46 ^c
T2	63.60	83.93 ^{cd}	89.56 ^{cd}	102.20 ^{bc}	115.33 ^{bc}	122.60 ^{bc}
T3	68.23	95.23 ^{bcd}	104.50 ^{bcd}	120.93 ^{abc}	134.26 ^{abc}	141.10 ^{abc}
T4	64.06	98.20 ^{bc}	110.83 ^{abc}	126.23 ^{abc}	139.63 ^{ab}	146.67 ^{ab}
T5	66.30	107.56 ^{ab}	112.26 ^{ab}	130.80 ^{ab}	150.16 ^a	157.10 ^a
T6	78.26	118.60 ^a	127.20 ^a	147.13 ^a	161 ^a	167.60 ^a
T7	72.13	104.13 ^{ab}	112.20 ^{ab}	130.86 ^{ab}	144.70 ^{ab}	153.06 ^{ab}
T8	71.80	97.83 ^{bc}	108.20 ^{abc}	124.03 ^{abc}	138.53 ^{ab}	145.53 ^{ab}
T9	72.56	98.26 ^{bc}	102.40 ^{bcd}	122.43 ^{abc}	134.36 ^{abc}	141.10 ^{abc}
T10	73.26	101.86 ^{abc}	111.60 ^{ab}	132.26 ^a	146.26 ^{ab}	151.70 ^{ab}
Sem±	2.52	3.76	4.17	5.72	6.13	6.11
F-test	Ns	<0.05	<0.05	<0.1	<0.1	<0.1
LSD	12.97	19.37	21.46	29.45	31.58	31.46
CV%	10.96	11.48%	11.77	13.90	13.45	12.75
Grand mean	69cm	98.32cm	106.31cm	123.49cm	136.85cm	143.79cm

CV: Coefficient of Variance, Sem±: Standard Error of Mean, %: Percentage, Cm: Centimeters, Ns: Non-significant, '*' Significant at 0.05 level, '.' Significant at 0.1 level, '**' Significant at 0.01 level, '***' Significant at 0.001 level, Value with the different letters are significant difference at 5% level of significance from LSD test, DAT; Days After Transplanting

3.2 Number of tillers per hills

The results from research work shows that measurement of number of tillers per hills at every date was not significantly influenced by various dose of Nitrogen (N) application. The average number of tillers per hills was 13.81, 15.46, 13.49,

11.10 and 9.94 at 30DAT, 45DAT, 60DAT, 75DAT, and 90DAT respectively. At 30DAT, 45DAT, and 60DAT number of tillers per hills was found highest in 'T6' i.e. 17.20, 20.83 and 16.53 and lowest number of tillers per hills from 'T1' i.e. 6.60, 8.5, 8.3 at 30DAT, 45DAT, and 60DAT

and all the other date there was not significant influenced by various dose of nitrogen (N) application shown in table 4. This result is similar as the results obtained from other field

trials. Highest number of tillers per hills was found at 45DAT with fertilizer application of 100kg N/ha (Haque and Haque, 2016) [8].

Table 4: Number of tillers per hills influenced by various dose of N application practices at Sundarharicha-7, Morang

Treatments	30DAT	45DAT	60DAT	75DAT	90DAT
T1	6.60 ^e	8.5 ^d	8.3 ^c	8.33	7.73
T2	10.53 ^d	12 ^{cd}	11.13 ^{bc}	9.36	8.63
T3	12 ^{cd}	13.03 ^{bcd}	11.83 ^{bc}	10.16	9.36
T4	14.63 ^{abc}	19.53 ^{ab}	14.50 ^{ab}	12.26	11.03
T5	16.33 ^{ab}	17.10 ^{abc}	14.86 ^{ab}	13.36	11.26
T6	17.20 ^a	20.83 ^a	16.53 ^a	11.63	9.76
T7	14.86 ^{abc}	16 ^{abc}	13.10 ^{ab}	11.67	10.43
T8	16.33 ^{ab}	14.20 ^{bcd}	14 ^{ab}	11.86	10.30
T9	16.26 ^{ab}	17.80 ^{abc}	13.86 ^{ab}	12.06	11.03
T10	13.33 ^{bcd}	15.60 ^{abc}	13.50 ^{ab}	10.33	9.90
Sem±	0.68	1.28	0.80	0.87	0.84
F-test	<0.001	<0.05	<0.05	NS	NS
LSD	3.51	6.60	4.16	4.52	4.36
CV%	14.81%	24.90%	18.44%	23.73%	25.55%
Grand mean	13.81	15.46	13.16	11.10	9.94

CV: Coefficient of Variance, Sem±: Standard Error of Mean, %: Percentage, Cm: Centimeters, Ns: Non-significant, '*' Significant at 0.05 level, '.' Significant at 0.1 level, '**' Significant at 0.01 level, '***' Significant at 0.001 level, Value with the different letters are significant difference at 5% level of significance from LSD test, DAT; Days After Transplanting

3.3 Yield attributing characters

The results revealed that various dose of N fertilizer application significantly influenced panicle length, number of grains per panicle, thousand grain weight, and sterility percent.

Panicle length was recorded highest in 'T6' (25.27cm), followed by 'T5' (23.55cm) and 'T4' (23.44cm). The lowest panicle length was observed from 'T1' (18.60cm). The increase in panicle length under high dose of N fertilizer application may be attributed to improved nutrient availability, which enhance vegetative growth and panicle development. Similar finding had been reported from the field experiment performed by Islam *et al.*, 2008) [9].

The highest number of grains per panicle was recorded from 'T6' (145.33), followed by 'T5' (118), while the lowest (73.33) was recorded in 'T2', which was statistically similar to 'T1' (75.66). The higher number of grains per panicle in

'T6' may be due to better nutrient uptake and enhanced photosynthetic activity, which supports spikelet formation.

The maximum thousand grain weight was recorded in 'T4' (17.45gm), followed by 'T7' (15.49gm) with minimum value (9.29gm) was observed in 'T1'. The higher thousand grain weight observed under recommended dose of fertilizer application may be due to better production and movement of assimilates towards the grains during the grain filling stage. When plants receive sufficient nutrients, they are able to develop and fill grains more effectively, resulting in heavier and well-developed grains (Dobermann and Fairhurst, 2000) [6]. The highest sterility percentage (70.90%) was observed in 'T1', while the lowest sterility (43.69%) was recorded in 'T4'. The reduction in sterility percentage under recommended fertilizer treated plot indicates better nutrient availability during reduction stages, which supports proper pollination and grain filling.

Table 5: Yield Attributing Characters influenced by various dose of N application practices at Sundarharicha-7, Morang

Treatments	Panicle length (cm)	Number of grains/ panicles	Thousand grain weight (gm)	Sterility percent (%)
T1	18.60 ^d	75.66 ^d	9.29 ^c	70.90 ^a
T2	19.62 ^{cd}	73.33 ^d	9.84 ^c	62.02 ^{ab}
T3	21.67 ^{bc}	97 ^{bcd}	13.51 ^b	57.62 ^b
T4	23.44 ^{ab}	89.67 ^{bcd}	17.45 ^a	43.69 ^c
T5	23.55 ^{ab}	118 ^{ab}	15.07 ^b	58.60 ^b
T6	25.27 ^a	145.33 ^a	13.64 ^b	59.91 ^b
T7	22 ^{bc}	110 ^{bc}	15.49 ^{ab}	53.61 ^{bc}
T8	21.49 ^{bc}	86.67 ^{cd}	13.87 ^b	58.37 ^b
T9	22.08 ^{bc}	99 ^{bcd}	13.77 ^b	58.53 ^b
T10	22.17 ^{bc}	107.33 ^{bc}	14.78 ^b	57.02 ^b
Sem±	0.52	5.81	0.43	2.05
F-test	<0.01	<0.01	<0.001	<0.01
LSD	2.69	29.93	2.25	10.57
CV%	7.14%	17.41%	9.59%	10.62%
Grand mean	21.99cm	100.2	13.67gm	58.03%

CV: Coefficient of Variance, Sem±: Standard Error of Mean, %: Percentage, Cm: Centimeters, Ns: Non-significant, '*' Significant at 0.05 level, '.' Significant at 0.1 level, '**' Significant at 0.01 level, '***' Significant at 0.001 level, Value with the different letters are significant difference at 5% level of significance from LSD test, DAT; Days After Transplanting

3.4 Yield

3.4.1 Grain yield, straw yield and Harvest index (HI)

Grain yield, straw yield and harvest index were significantly influenced by various dose of N fertilizer application as indicated by F-test values (<0.001 for grain yield and harvest index, and <0.01 for straw yield).

The highest grain yield was recorded in 'T4' (6.08 mt/ha), followed by 'T7' (4.98 mt/ha) and 'T10' (4.77 mt/ha), while the lowest was observed from 'T1' (1.54 mt/ha). The highest straw yield was recorded from 'T4' (12.43 mt/ha), was statistically similar to 'T7' (12.27 mt/ha), and 'T10' (12.06 mt/ha), while the lowest was observed from 'T1'

(6.84 mt/ha). The highest HI was observed from 'T4' i.e. 0.32, followed by 'T7' and 'T10' i.e. 0.28 and 0.28 respectively, while the lowest was recorded from 'T1' i.e. 0.17. The increase in grain yield, straw yield, and harvest index under recommended dose of N fertilizer application which may be due to the improved vegetative growth, number of productive tillers, better grain filling and increase in panicle length and number ultimately enhancing yield. Similar result shown increase in grain yields due to transplanting of younger seedling (20 days) maintaining low seedling density with nitrogen application (Subedi., 2013) [13].

Table 6: Yield of rice influenced by various dose of N application practices at Sundarharicha-7, Morang

Treatments	Grain Yield (mt/ha)	Straw Yield (mt/ha)	Harvest Index
T1	1.54 ^f	6.84 ^c	0.17 ^d
T2	2.56 ^e	9.63 ^b	0.20 ^{cd}
T3	2.97 ^{de}	10.38 ^{ab}	0.22 ^{cd}
T4	6.08 ^a	12.43 ^a	0.32 ^a
T5	3.30 ^{cd}	11.02 ^{ab}	0.22 ^{bcd}
T6	3.26 ^{cde}	10.88 ^{ab}	0.22 ^{bcd}
T7	4.98 ^b	12.27 ^a	0.28 ^{ab}
T8	3.79 ^c	11.31 ^{ab}	0.25 ^{bc}
T9	3.58 ^{cd}	11.42 ^{ab}	0.23 ^{bcd}
T10	4.77 ^b	12.06 ^a	0.28 ^{ab}
Sem±	0.13	0.46	0.011
F-test	<0.001	<0.01	<0.01
LSD	0.71	2.37	0.058
CV %	11.24%	12.79%	13.90%
Grand mean	3.68 mt/ha	10.82 mt/ha	0.24

CV: coefficient of Variance, Sem±: Standard Error of Mean, %: Percentage, Cm: Centimeters, Ns: Non-significant, '*' Significant at 0.05 level, '.' Significant at 0.1 level, '**' Significant at 0.01 level, '***' Significant at 0.001 level, Value with the different letters are significant difference at 5% level of significance from LSD test, DAT; Days After Transplanting

3.5 Correlation

Pearson correlation heatmap shows which growth parameters are actually driving the final yield. Dark blue (near+1) shows the strong positive correlation means if one factor increases, others factor also increases. Dark orange (near-1) shows the strong negative correlation means if one increases, other decreases. White color shows the no relationship. The fertilizer might be increasing one trait but it isn't affecting other. Pearson

correlation analysis revealed that grain yield was most strongly and positively associated with thousand grain weight ($r = 0.89$, $p < 0.001$), followed by straw yield ($r = 0.58$, $p < 0.001$). this suggests that the experimental treatments enhanced yield primarily by improving grain filling and overall biomass, whereas sterility percent showed a significant negative correlation with grain yield ($r = -0.66$, $p < 0.001$), identifying it as the primary limiting factor for productivity in this trial.

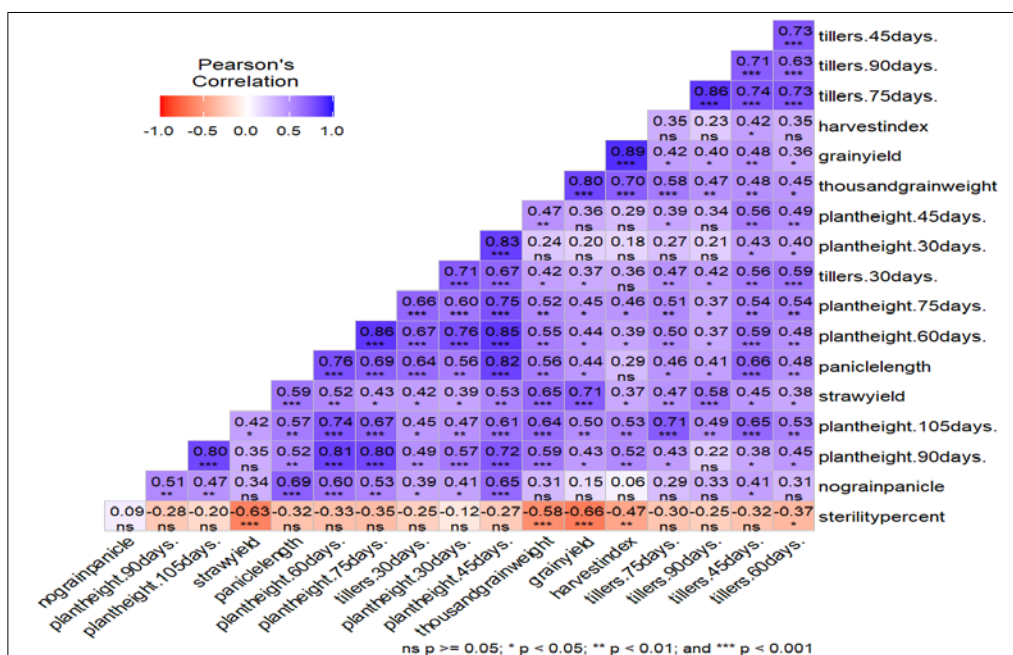


Fig 2: Pearson's Correlation Heatmap of Growth, Yield, and Yield-Contributing Traits in Rice

4. Conclusion

The study clearly indicated that use of various dose of Nitrogen (N) fertilizer application had profoundly influence the plant height, number of tillers per hills, yield and yield attributing characters of transplanted rice. Increasing nitrogen levels can reduces the poor crop growth, and low yield associated with insufficient nitrogen application.

The results revealed that treatment 'T6' has the best performance among the 10 treatments used in the field trials, in terms of highest plant height, number of tillers per hills, and panicle length, where 'T4' has the highest grain yield, straw yield, and harvest index this may be due to the response to nitrogen is not linear beyond the optimum level, as excessive nitrogen lead to reduce efficiency due to increase sterility, lodging and unproductive tillers. Hence the application of high nitrogen fertilizer as a 'T6' can be suited for the low fertile soil while the soil with high fertility can cause lodging of rice plant and reduces the yield.

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