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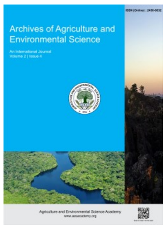

ORIGINAL RESEARCH ARTICLE

CrossMark

Varietal evaluation of spring rice (*Oryza sativa* L.) genotypes in Kanchanpur, Nepal

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ABSTRACT

A field experiment was carried out on spring rice in the rabi season of 2022 from February 3 to July 4 with an aim to identify the most suitable spring rice cultivar in Kanchanpur, Nepal. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications and eight treatments. The treatments were eight spring rice genotypes: one released (Chaite-5), one local genotype (ChaineeAndi), and six pipeline varieties (IR17A2946, IR17A2796, IR17A2949, IR13F402, IR16A3838, and IR18A2066). A total of 24 experimental plots, each of 6m^2 (3*2m), were set to the experimental design. The treatments were randomly assigned to the replications. Data were collected for various morphological characters such as plant height (cm), number of tillers (/plant), effective tillers (/m^2), panicle length (cm), number of grains per panicle, sterility (%), thousand-grain weight (gm), grain yield (kg), straw yield (kg), biological yield (kg), and harvest index. Results revealed significance for all parameters except for the effective number of tillers per plant. ChaineeAndi took the least days to mature and had the highest effective tiller number per plant. Genotype IR17A2066 took the most days to flower and mature, and had greater plant height, thousand-grain weight, but low grain yield. Grains per panicle were higher in IR13F402 but lowest panicle length. Chaite-5 had the highest sterility percentage. Highest grain yield, straw yield, and harvest index was observed in genotypes IR16A3838, IR17A2946, Chaite-5, and IR17A2949. IR16A3838 performed superior than other genotypes in environmental conditions of Kanchanpur, Nepal.

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INTRODUCTION

Rice (*Oryza sativa* L.) is an annual, semi-aquatic plant belonging to the family Poaceae. It is one of the most important staple food crops, with over 512 million tons of paddy produced globally in the year 2022/23 (USDA, 2022). Over 90% of the world's paddy is produced and consumed in the Asia-Pacific region alone (Papademetriou, 2000) making the Asia-Pacific region an important hub for global rice production. A total of 5,550,878 Mt of rice were produced in Nepal in the year 2020/21 from 1458915 ha of land (MOALD, 2021) making it the 17th largest producer of rice worldwide (Choudhary *et al*., 2022). Nepal's food security is highly dependent on staple food production and rice being the most produced staple crop (MOALD, 2022), has a direct influence on nutrition, food security, and national GDP. Rice alone contributes11.30% to the Country's national GDP (MOALD, 2022) and is the main food crop for more than 90% of the population occupying 56% of the total cereal consumption in the country (Choudhary *et al*., 2022). However, the productivity of rice has been halted to only 3.8mt/ha (MOALD, 2021). Nepal Agriculture Research Council (NARC) is the main governmental body responsible for the development and distribution of different rice varieties within the nation. To date, a total of 6 spring-season rice and 124 summer-season rice varieties have been released by the NARC (Krishi Dairy, 2022). The season of rice cultivation in Nepal is mostly compacted in the kharif season and only a few farmers have adopted spring rice cultivation practice. Rapid population growth, plotting land for residential use (Gyawali and Saugat, 2021), increasing trend of land abandonment, and leaving fallow land in hills (Paudel *et al*., 2014) are the leading factor that the production area of paddy reduced from 1.5 million ha in 2010/11 (Tripathi *et al*., 2019) to 1.4 million ha in 2021 (MOALD, 2021). As per the researchers, Timsina *et al*., 2023 Nepal should increase the current productivity of rice by at least 27–43% by 2030 and 42–85% by 2050 to meet the projected population of the country by 2030 and 2050 respectively. The government of Nepal's recommendation for varietal suitability is not tailored to specific locations; instead, it applies broadly to larger areas. However, it's important to note that variations in climatic conditions can significantly affect how well a genotype performs (Salleh *et al*., 2022). The recommendations made on Krishi dairy 2022 about the varietal suitability is merely broader then specific and need more detailed area specific recommendation.

Under this scenario with limited available resources, it will be a challenging task to meet the increasing demand of the growing population with the currently available resources. To meet the demand of increasing population growth of 2.3% (Tripathi *et al*., 2019), either the country needs to industrialize its agriculture productivity with high-yielding rice varieties or double the production time; producing rice in the summer and spring seasons. Compared to main-season rice, spring rice cultivation is more advantageous and has high benefit-cost ratio than the main season rice (Ajay *et al*., 2020). Spring rice varieties are photoperiod-insensitive, yields higher compared to regular rice, primarily attributed to an increased number of sunny days, improved fertilizer utilization, enhanced water management, and reduced weed encroachment (Shrestha *et al*., 2022). Additionally, spring rice exhibits greater efficiency, as it experiences lower production losses due to its resistance against various diseases and pest. The objective of the study was to study the phenology, growth and yield characters of different spring rice varieties and to identify the better performing spring rice varieties in the study area.

MATERIALS AND METHODS

The study is based on both the literature review and the experimental findings of the research trial. An experimental trial was conducted during the kharif season of 2022 from February to July in the Kanchanpur district of the Federal Democratic Republic of Nepal. The secondary source of data are journal articles, web profile of governmental and non-governmental organizations, newspapers, and textbooks.

Research site and location

The experiment was carried out at the farmer's field of Laljhadi Rural municipality-03 Kanchanpur district, province no 7 of the Federal Democratic Republic of Nepal. Geographically, it is located at 28.764°N latitude and 80°.427"E longitude with an elevation of around 175 meters above sea level. This district has a Tropical climate with hot dry summers, moderate rainfall, and cold winters with mean annual temperatures between 43˚C and 3˚C Most of the precipitation here falls in July and the annual average rainfall is 1771.5mm. Out of the total area, 34.90% (56,602 ha) of the area falls under cultivated land, 54.53% (88,200 ha) under forest area, and 10.57% (16,939 ha) area under others. The district can be divided into 2 geographical zones based on climate. The lower tropical region covers 85.2% of the total area, the upper tropical region covers 13%, and the remaining 1.8% is covered by the Subtropical climatic region.

Experimental design

The experiment was laid out on Randomized Complete Block Design (RCBD), with three replications and eight treatments. The treatments were assigned at random to each block. The size of each plot is set as 6 m^2 (2×3 m). A distance of 1m was set in between each block and a distance of 0.4m was set in between each two plots. The treatments were eight spring rice genotypes; one released (Chaite-5), one local genotype (Chaineeandi), and six pipeline varieties (IR17A2946, IR17A2796, IR17A2949, IR13F402, IR16A3838, and IR18A2066). A total of 24 experimental plots each of 6m^2 (3×2 m) were set to the experimental design. A spacing of 20×20 cm plant-plant and row-row was maintained. The samples were selected at random from each plot of every replication. Five samples were selected at random from the middle 1 m^2 area of each plot. The plants were tagged with red ribbons to identify the sampled plants and to avoid any errors.

Design: Randomized Complete Block Design (RCBD)

No. of Replications: 3
No. of Treatments: 8
Individual plot size: 2*3 m^2
Spacing between Replications: 1 m
Spacing Between treatment: 0.4 m

Treatments:

Treatment 1: IR17A2796	Treatment 2: IR17A2946
Treatment 3: IR17A2949	Treatment 4: IR13F402
Treatment 5: IR16A3838	Treatment 6: IR18A2066
Treatment 7: Chaite-5	Treatment 8: ChaineeAndi

Data collection

Data were collected from ten sampled plants for plant height, number of tillers per meter square, number of effective tillers per meter square, effective tillers per plant, panicle length, flag leaf length, grains per panicle, and thousand-grain weight. Data were recorded at 15 day's intervals from 15DAT to 60 DAT. The plant height was measured from the ground level to the tip of the topmost leaf at early stages (15 DAT, 30 DAT, 45 DAT, 60 DAT), up to the tip of the main panicle at physiological maturity and the average height was expressed in cm. The number of effective tillers in a row within the net plot area was recorded in every plot before harvesting the crop and then was converted to per m^2. At the same time, the numbers of filled and unfilled grains were also counted from 10 panicles of each plot to determine the number of filled grains per panicle and sterility percentage.

The sterility percentage was calculated by using the following formula.

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

Yield and yield parameters of rice

Grain yield

Grains were separated from the straw of each net plot of area 6 m^2 by threshing separately and moisture percent of fresh grain was recorded. From these net plot values; grain yield was converted into ton per hectare at 14 % moisture.

$$\text{Grain Yield (kg/ha)} = \frac{(100 - \text{MC}) * \text{plot yield (kg)} * 1000\ (\text{m}^2)}{(100 - 14) * \text{Net plot area}\ (\text{m}^2)}$$

Where, MC: Moisture content of fresh grain yield

Straw yield

Straw from each net plot was dried under the sun & dried weight was recorded and expressed in tons per hectare after calculation.

Harvest index

The harvest index is computed from grain and straw yields using the formula given:

$$\text{Harvest index} = \frac{\text{Economic yield}}{\text{Biological yield}}$$

Data analysis

The data was analyzed using MS-excel 2021, and R-studio.

RESULTS AND DISCUSSION

Variations were observed for the different study parameters; phenological, biometric, and yield attributing character of spring rice among the different varieties during the study.

Phenological character

Days to reach flowering and maturity were taken into consideration for determining the phenological character of spring season rice varieties. Different genotypes showed variation in the time taken to flower and reach maturity from the days after transplantation (Table 1). Genotype IR17A2066 (65.67 DAT) took the most days to flower followed by IR13F402 (62 DAT), ChaineeAndi (60.33 DAT), IR16A3838 (60DAT) and Chaite-5 (60 DAT). Genotype IR17A2946 (48DAT) took the least days to flower followed by IR17A2949 (58 DAT) and IR17A2796 (57.67 DAT). In terms of maturity, genotypes IR17A2066 (85.67 DAT) and Chaite-5 (85DAT) took the most days to mature followed by IR17A2946 (82.67DAT), IR13F402 (82 DAT) and IR17A2946 (82.67 DAT) (Table 1). Genotype ChaineeAndi (77.33 DAT) took the least days to reach maturity. ChaineeAndi was thus identified as an early maturing genotype whereas IR17A2066 was identified as a late maturing variety. The results are in accordance with the research conducted by Puri *et al.* (2021) who reported that days to flowering, plant height, grain/panicle, thousand-grain weight, grain yield, and harvest index were significantly influenced by the varieties. This shows that the morphological characteristics of plants highly depend on genotype.

Biometrical observation

Plant height

Variations were observed among different rice genotypes for plant height. At 30 DAT, Chaite-5, had superior plant height (50.90cm) followed by IR17A2066 (50.17cm), IR16A3838 (49.97 cm), IR17A2796 (49.53cm), IR17A2949 (45.47 cm), ChaineeAndi (45.7cm) and IR13F402 (43.60 cm) (Table 2). Genotype, IR17A2946 had the lowest plant height (41.67 cm). At 45 DAT, Genotype IR17A2066 showed superior plant height (77.07 cm) followed by Chaite-5 (73.70cm), IR17A2796 (71.73cm), IR16A3838 (67.07 cm), IR17A2949 (64.30 cm) and ChaineeAndi (62.70cm). Genotype, IR17A2946 had the lowest plant height (58.30cm). At 60 DAT, Genotype IR17A2066 showed superior plant height (97.77cm) followed by Chaite-5 (94.10 cm), IR17A2796 (92.60cm), IR16A3838 (91.53cm) IR17A2949 (85.33 cm), and IR17A2946 (83.43 cm). Genotype, ChaineeAndi had the lowest plant height (78.07 cm). At harvest, Superior plant height was observed in IR17A2066 (100.37cm) followed by IR17A2796 (98.30 cm), Chaite-5 (94.10 cm), IR16A3838 (91.53cm), and IR17A2949 (93.23 cm). Genotype, ChaineeAndi (83.90 cm) had the lowest plant height.

Table 1. Varietal evaluation for different flowering and maturity.

Variety	Flowering days (DAT)	Maturity days (DAT)
IR13F402	62.00^{b}	82.00^{ab}
IR17A2796	57.67^{c}	79.00^{bc}
ChaineeAndi	60.33^{bc}	77.33^{c}
IR17A2066	65.67^{a}	85.67^{a}
IR17A2946	48.00^{d}	82.67^{ab}
IR17A2949	58.00^{c}	80.00^{bc}
IR16A3838	60.00^{bc}	79.00^{a}
Chaite-5	60.00^{bc}	85.00^{a}
SEm (±)	0.93	1.12
LSD (0.05)	2.825	3.42
CV, %	2.7	2.4
F Probability	**	**
Grand mean	58.83	81.33

Note: DAT, Days After Transplantation; SEm, Standard Error of Mean; LSD, Least Significance Difference; CV, Coefficient of Variation; *** Represent Significant at 0.1% level; ** Represent Significant at 1% level. Treatment means followed by the same letter(s) are non-significance differences on Duncan multiple range test at 0.05 level of significance.

Table 2. Plant height (cm) of different spring rice genotypes at different DAT.

Variety	Plant height (cm)				
	15DAT	30DAT	45DAT	60DAT	At harvest
IR13F402	31.82^{c}	43.60^{bc}	61.23^{de}	79.73^{c}	84.90^{de}
IR17A2796	36.93^{a}	49.53^{a}	71.73^{ab}	92.60^{a}	98.3^{a}
ChaineeAndi	33.90^{abc}	45.07^{b}	62.70^{cde}	78.07^{c}	83.90^{e}
IR17A2066	36.37^{ab}	50.17^{a}	77.07^{a}	96.77^{a}	100.37^{a}
IR17A2946	31.73^{c}	41.67^{c}	58.30^{e}	83.43^{bc}	89.33^{cd}
IR17A2949	34.00^{abc}	45.47b	64.30^{cd}	85.33^{b}	93.23^{bc}
IR16A3838	37.27^{a}	49.97^{a}	67.07^{bc}	91.53^{a}	95.60^{ab}
Chaite-5	32.63^{bc}	50.90^{a}	73.70^{bc}	94.10^{a}	96.97^{ab}
Sem (±)	1.17	0.980	1.684	1.727	1.462
LSD(0.05)	3.55	2.973	5.107	5.239	4.435
CV (%)	5.90	3.6	4.4	3.4	2.7
F Probability	ns	*	***	***	***
Grand mean	34.33	47.05	67.01	87.7	92.82

Note: DAT, Days After Transplantation; SEm, Standard Error of Mean; LSD, Least Significance Difference; CV, Coefficient of Variation; *** Represent Significant at 0.1% level and * Represent Significant at 5% level of Significance. Treatment means followed by the same letter(s) are non-significance differences on Duncan multiple range test at 0.05 level of significance.

Table 3. Number of tillers per plant of different rice genotypes at different DAT.

Variety	Number of tillers per plant			
	15DAT	30DAT	45DAT	60DAT
IR13F402	3.9^{ab}	11.47^{bc}	16..90^{b}	14.73^{abc}
IR17A2796	5.433^{a}	12.73^{ab}	18.17^{ab}	15.67^{ab}
ChaineeAndi	4.30^{ab}	12.33^{ab}	20.40^{a}	17.33^{a}
IR17A2066	3.200^{b}	8.90^{d}	10.63^{c}	9.80^{c}
IR17A2946	4.200^{ab}	12.07^{ab}	18.27^{ab}	14.47^{abc}
IR17A2949	4.800^{ab}	14.27^{a}	15.67^{b}	13.23^{abc}
IR16A3838	4.700^{ab}	10.63^{bcd}	15.73^{b}	12.90^{abc}
Chaite-5	3.500^{b}	8.97^{cd}	11.43^{c}	11.47^{bc}
SEm (±)	0.559	0.801	1.652	1.467
LSD (0.05)	1.695	2.431	5.011	4.450
CV %	22.8	12.2	20.9	19.1
F Probability			*	*
Grand Mean	4.25	11.41	13.70	13.28

Note: DAT, Days After Transplantation; SEm, Standard Error of Mean; LSD, Least Significance Difference; CV, Coefficient of Variation; * Represent Significant at 5% level of Significance. Treatment means followed by the same letter(s) are non-significance differences on Duncan multiple range test at 0.05 level of significance.

Table 4. Yield attributing character of different spring season rice genotypes.

Variety	Effective tillers per plant	Panicle Length	Grains per Panicle	Sterility (%)	1000 grain Weight (g)
IR13F402	13.2	23.73^{b}	151.53^{ab}	42.92^{ab}	19.67^{b}
IR17A2796	15.27	26.93^{a}	121.63^{bc}	16.12^{d}	30.67^{a}
ChaineeAndi	16.53	26.17^{ab}	139.13^{abc}	20.72^{cd}	24.33^{b}
IR17A2066	9.60	26.43^{ab}	128.03^{bc}	32.91^{bc}	32.33^{a}
IR17A2946	15.53	27.31^{a}	122.36^{bc}	40.63^{ab}	21.67^{b}
IR17A2949	12.60	25.92^{ab}	106.56^{c}	23.42^{cd}	24.33^{b}
IR16A3838	12.37	27.05^{a}	115.23^{bc}	19.17^{cd}	25.00^{b}
Chaite-5	11.13	25.79^{ab}	172.73^{a}	49.69^{a}	22.33^{b}
SEm (±)	8.10	0.908	359.36	4.72	1.748
LSD (0.05)	-	2.754	3.83	14.32	5.302
CV %	26.19	6.0	14.34	26.6	12.1
F Probability	ns	***	***	***	***
Grand mean	166.48	26.17	132.15	30.7	25.04

Note: SEm, Standard Error of Mean; LSD, Least Significance Difference; CV, Coefficient of Variation; *** Represent Significant at 0.1% level. Treatment means followed by the same letter(s) are non-significance differences on Duncan multiple range test at 0.05 level of significance.

Number of tillers per plant

At 15 DAT and 30 DAT, the number of tillers were found non-significant at a 5% level of significance (Table 3). At 45 DAT, genotypes ChaineeAndi (20.40/plant) had the highest number of tillers per plant followed by IR17A2946 (18.27/plant), IR17A2796 (18.17/plant), IR13F402 (16.90/plant), IR16A3838 (15.73/plant) and IR17A2949 (15.67/plant). Similarly, IR17A2066 had the lowest number of tillers per plant (10.63/plant). At 60 DAT, Genotypes ChaineeAndi (17.33/plant) had a higher number of tillers per plant followed by IR17A2796 (15.67/plant), IR13F402 (14.73/plant), IR17A2946 (14.47/plant), IR17A2949 (13.23/plant), IR16A3838 (12.90/plant) and Chaite-5 (11.47/plant). Similarly, IR17A2066 had the lowest number of tillers per plant (9.80/plant).

Yield attributing characters of rice

For yield attributing character, effective tiller/plant, panicle length, grain per panicle, sterility percentage, and thousand-grain weight, were taken into consideration (Table 4). Among these parameters, effective tillers/plant was non-significant while other remaining parameters were found highly significant at 0.1% level of significance. The number of effective tillers were significantly influenced by varieties. Tillers per plant were observed significantly higher in ChaineeAndi (16.53 per plant) followed by IR17A2946 (15.53/plant), IR17A2796 (15.27/plant), IR13F402 (13.20/plant), IR17A2949 (12.60/plant), IR16A3838(12.37/plant), Chaite-5 (11.13/plant) and IR17A2066 (9.60/plant), respectively. Genotypes, IR17A2946 had the largest panicle (27.31cm) followed by IR16A3838 (27.05 cm), IR17A2796 (26.93 cm), IR17A2066 (26.43 cm), ChaineeAndi (26.17 cm), IR17A2949 (25.92 cm) and Chaite-5 (25.79 cm). Genotype IR13F402 (23.75 cm) had the smallest panicle length. Genotype Chaite-5 (172.73) had more grains per panicle followed by IR13F402 (151.53), and ChaineeAndi (139.13). Lowest number of grains per panicle were observed in genotype IR17A2949 (106.56). Genotypes Chaite-5 had the highest sterility percent (49.69%) followed by IR13F402 (42.92 %), IR17A2946 (40.63%) IR, and 17A2066 (32.33%). GenotypeIR17A2796 (16.12 %) had the lowest sterility percentage. Genotype IR17A2066 had the highest thousand grain weight (32.33 gm) followed by IR17A2796 (30.67g), and IR16A3838 (25.0g). The lowest thousand-grain weight was observed in genotype IR13F402 (19.67g). A significant difference was observed among different genotypes for tillers/m^2. The results show that, the number of tillers/m^2 were highly influenced by varieties grown. Shrestha *et al*. (2022) also found a significant difference for tillers/m^2 among different pipeline genotypes of rice. Effective tiller per square meter was found non-significant among the different varieties of spring rice. The results are in accordance with that conducted by Saphi (2016). Subedi *et al*. (2018) also reported that the yield attributing character of varieties is dependent on their genetic makeup and selection of genotype is dependent on the presence of gene of farmer's interest in the varieties.

Yield parameters of rice

Grain yield, straw yield, biological yield, and harvest index were taken into consideration to determine the potential productivity of rice varieties (Table 5). Genotype IR16A3838 (8.47ton/ha) had the highest grain yield followed by IR17A2946 (7.82ton/ha), Chaite-5 (7.45 ton/ha), and IR17A2949 (6.99ton/ha). The least grain yield was observed in genotype IR17A2066 (2.56 ton/ha). The highest straw yield was observed in genotype IR16A3838 (11.4ton/ha) followed by IR17A2946 (10.59 ton/ha), Chaite-5 (9.70ton/ha), and IR17A2949 (7.86ton/ha). The low straw yield was observed in genotype IR17A2796 (3.20 ton/ha). Genotype IR16A3838 (19.87 ton/ha) had the higher biological yield followed by IR17A2946 (18.41 ton/ha), Chaite-5 (17.15 ton/ha), and IR17A2949 (14.85 ton/ha). The lowest biological yield was observed in genotype IR17A2796 (5.82 ton/ha). The harvest index was found significantly higher in genotypeIR17A2949 (0.47) followed by ChaineeAndi (0.465). The lower harvest index was observed in genotype IR13F402 (0.40). Variations were observed among genotypes for their yield and yield attributing characters grown under same condition which showed the dependency of yield on genotype cultivated. The result is in accordance with that of Subedi *et al.* (2018) who reported that the yield and yield attributing characters vary significantly among the genotypes. Shah and Akhtar (2011) also reported significant differences in days to maturity among different genotypes of rice. The sterility percentage and straw yield were highly influenced by the genotypes grown. Won *et al.* (2020), also observed highly significant differences in sterility percent among different genotypes of rice. Matias *et al.* (2019) found highly significant differences in straw yield among different genotypes of rice.

Table 5. Yield of different rice genotypes during the spring season of 2022.

Varieties	Yield			
	Grain yield (ton/ha)	Straw yield (ton/ha)	Biological yield (ton/ha)	Harvest index (ton/ha)
IR13F402	3.41^b	5.10^c	8.51^c	0.400^d
IR17A2796	2.62^b	3.20^c	5.82^c	0.448^b
ChaineeAndi	3.51^b	4.03^c	7.54^c	0.465^a
IR17A2066	2.56^b	3.60^c	6.15^c	0.419^c
IR17A2946	7.82^a	10.59^a	18.40^{ab}	0.4249^c
IR17A2949	6.99^a	7.86^b	14.84^b	0.470^a
IR16A3838	8.47^a	11.40^a	19.87^a	0.425^c
Chaite-5	7.45^a	9.7^a	17.11^{ab}	0.436^{bc}
SEm (±)	0.513	0.753	4.956	8.546
LSD (0.05)	1.555	2.283	2.54	2.74
CV %	16.6	18.8	18.12	2.11
F Probability	***	***	***	***
Grand Mean	5.35	6.93	12.28	0.43

Note: SEm, Standard Error of Mean; LSD, Least Significance Difference; CV, Coefficient of Variation; *** Represent Significant at 0.1% level; * Represent Significant at 5% level of Significance. Treatment means followed by the same letter(s) are non-significance differences on Duncan multiple range test at 0.05 level of significance.

Conclusion

In the study, various genotypes exhibited variations in phenological, biometric, and yield-related characteristics under the environmental conditions of Kanchanpur, Nepal. Genotype ChaineeAndi took the least days to mature and had the highest number of effective tillers per plant. Genotype IR17A2066 took most days to flower and mature and had superior plant height, thousand-grain weight, but low grain yield. Though grain per panicle was highest in IR13F402, it had shorter panicle length. Chaite-5 showed highest sterility percent and IR16A3838 showed the highest grain yield followed by genotypes IR17A2946, Chaite-5, and IR17A2949.However, the straw yield was lower in Chaite-5 genotype. This study suggests that genotypes IR16A3838, IR17A2946, and IR17A2949 are the promising genotypes in terms of overall performance in Kanchanpur, Nepal.

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Conflict of Interest

The authors declare that there is no conflict of interest with the publication of this manuscript.

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