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Varietal trial of maize (*Zea mays* L.) for evaluation of growth and yield parameters in Terai region of Nepal

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Abstract: Hybrid maize is known for having a higher potential yield in contrast to open-pollinated varieties. Nonetheless, their production capabilities differ based on the specific geographical area and the prevailing local climate conditions. Finding a potential hybrid of maize that could be grown in Nepal's terai region was the main goal of this study. Randomized Complete Block Design with 5 varieties and 4 replications was used in this experiment in Bhadrapur, Jhapa, Nepal to identify the best productive maize variety. According to the study, grain yield showed a substantial and positive correlation with cob attributes and yield components but a negative correlation with phenological traits. The tallest variety during the experiment was Pioneer 3396 (220.72cm). Rampur composite with 67.25 days and Pioneer 3396 with 69.00 days showed earlier days to anthesis. Based on these findings, the two hybrids with the highest grain yields were CP 808 (7.18 t/ha) and Pioneer 3396 (6.17 t/ha). As a result, these two hybrids, rather than other available hybrids, are thought to be the most promising variety and are strongly advised for cultivation in the research area.

Keywords: *Zea mays*, Varieties, Grain yield, Correlation, Phenological traits

INTRODUCTION

One of the most important cereal crops in the world, maize (Zea mays L) is used as a raw material for many agricultural industries as well as a critical source of food for humans and animals (Bahadur Kunwar & Shrestha, 2014; Yadav et al., 2023). This plant, a member of the Poaceae family, is revered as "the queen of the cereals" (Neupane et al., 2020; Ghimire et al., 2023). The second most important food crop in Nepal is maize, which is grown over a vast area totaling 870,166 hectares, or 28.15 percent of the nation's total arable land (Mehata et al., 2023a). Maize has a remarkable capacity for climate adaptation, which enables it to flourish in a variety of environments from Nepal's steep terrain to the Terai and Inner-Terai regions (Bahadur Kunwar & Shrestha, 2014). In the past 50 years, maize has gained widespread recognition for its role in boosting global silage fodder production, thanks to its high nutritional value and appealing taste (Keskin et al., 2017; Keskin et al., 2018). The versatility of maize distinguishes it from other cereal crops (Prasai et al., 2015; Yadav et al., 2024). Despite having an average yield in Nepal of only 2.15 tons per hectare, maize is nonetheless an important crop since it can support livelihoods in a variety of climatic situations (Mehata et al., 2023b; Yadav et al., 2023a). Maize is a significant crop for farmers in the highlands because it is their main source of nourishment (Prasai et al., 2015). These farmers frequently use rainfed farming techniques, although irrigation techniques are more prominent in Nepal's Terai and Inner-Terai regions (Thapa et al., 2022; Yadav et al., 2023b). While maize is primarily grown in the hills and mountains during the summer, it is also grown in the Terai region in both the spring and summer (Neupane et al., 2020).

Each year, there is a noticeable rise in the market's demand for hybrid maize seed (Kandel, 2021). However, only a few number of commercial hybrids are acceptable for cultivation despite the country's varied agro-ecological areas and it is essential to find hybrids that are suitable for the unique climatic

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circumstances in various places (Shrestha et al., 2015). The cultivation of maize has a number of difficulties, including problems with low fertility, subpar management techniques, a lack of improved varieties, and a greater FAW infestation rate, production of maize is substantially impacted by these elements (Manjunatha et al., 2018). Except for Poshilo Makai-1, the released maize varieties in Nepal are mostly of the common type (Shrestha et al., 2015). Additionally, the lysine concentration in the protein in these maize types is just 2%, which is regarded as being less than half the amount advised for a normal human diet (Neupane et al., 2020).

Every year, the area used for hybrid maize production grows, and it now takes approximately 7 to 10% of the total area (Kammo et al., 2019). The national production of maize, at 2.59 tons per hectare, is still much lower than that of developed nations, which typically achieve yields of 6 to 10 tons per hectare, despite the growing cultivation of hybrid seeds (Thapa et al., 2022). This disparity in yield may be due to the unrestricted dissemination of imported hybrid seeds without the use of performance testing (Kandel & Shrestha, 2020). The lack of hybrid choices, restricted access to better seeds created by the national system, and the existence of biotic and abiotic challenges (including pests, diseases, temperature extremes, drought, and waterlogging) all affect maize productivity and production levels (Koirala et al., 2020). Low temperature is the abiotic factor that most significantly affects the growth, yield, and productivity of maize plants (Balassa et al., 2022). The structure and metabolic functions of maize plants can be harmed by low temperatures below 10°C, which can reduce photosynthesis and cause protein denaturation (Balassa et al., 2022). The key elements found as influencing maize yield and season-to-season variability are drought and low nitrogen stressors (Setimela et al., 2017). Since maize is a rich source of protein and energy for people and animals alike, increasing maize production is an essential method for maintaining food security in developing nations like Nepal (Manjunatha et al., 2018). Hybrid maize is a good option for farmers because of its varied genetic makeup, which enables it to withstand pest attacks (Elmyhun & Mekonen, 2016). Providing 19.5% of all caloric consumption globally, maize has the potential to become a big industrial crop (Waqas et al., 2021).

In the 1980s, farmers in Nepal started growing hybrid maize using seeds that they imported from India (Koirala et al., 2020). In Nepal, hybrid maize research first began in 1987 (Koirala et al., 2020). During the summer, maize is often produced as a single crop under rainfed circumstances, with millet occasionally intercropped (Prasai et al., 2015). It has a wide range of genetic variety and can be categorized according to environment, maturity level, and cultivation goal (Mangelsdorf, 1947). It is essential to create hybrids that can flourish and produce effectively in many environmental circumstances in order to obtain sustainable maize yields (Pepo & Pepo, 1993). Developing nations like Nepal are currently experiencing a shortage of maize since demand is higher than supply for both human consumption and animal feed (Paudyal et al., 2001). The prevalence of many plant diseases, particularly fungal and bacterial infections, which can severely harm the crop at different stages, is another cause behind the low maize output (Bhusal & Bhattarai, 2019). There were no improved maize varieties available in Nepal when the inquiry into maize illnesses started in 1964–1965 (Subedi, 2015; Manjunatha et al., 2018). Given these conditions, the study's aim to identify the best-performing varieties for this specific agro-ecological zone. Farmers, agricultural extension workers, policy makers, and the local economy stand to benefit from the findings through improved maize productivity and resilience. The study contributes to the scientific community by expanding knowledge on maize cultivation under Terai conditions, providing valuable data and methodology for further research. Identifying high-yielding varieties can lead to the development of best practices for maize cultivation and promote sustainable agriculture. The results will be disseminated through scientific publications and agricultural networks, enhancing global crop improvement efforts.

MATERIALS and METHODS

Study Area Details

This study was carried out at a farmer's field located in Bhadrapur-10, Jhapa (26.5444°N 88.0944°E) in Nepal's terai region. The study site, situated at an elevation of 91 meters above sea level, experiences a climate with high humidity, featuring chilly winters and scorching summers. Figure 1 and 2 illustrates the specific climatic information of the experimental location. The soil in the study area ranged from sandy loam to clay loam and had a pH value of approximately 5.49.

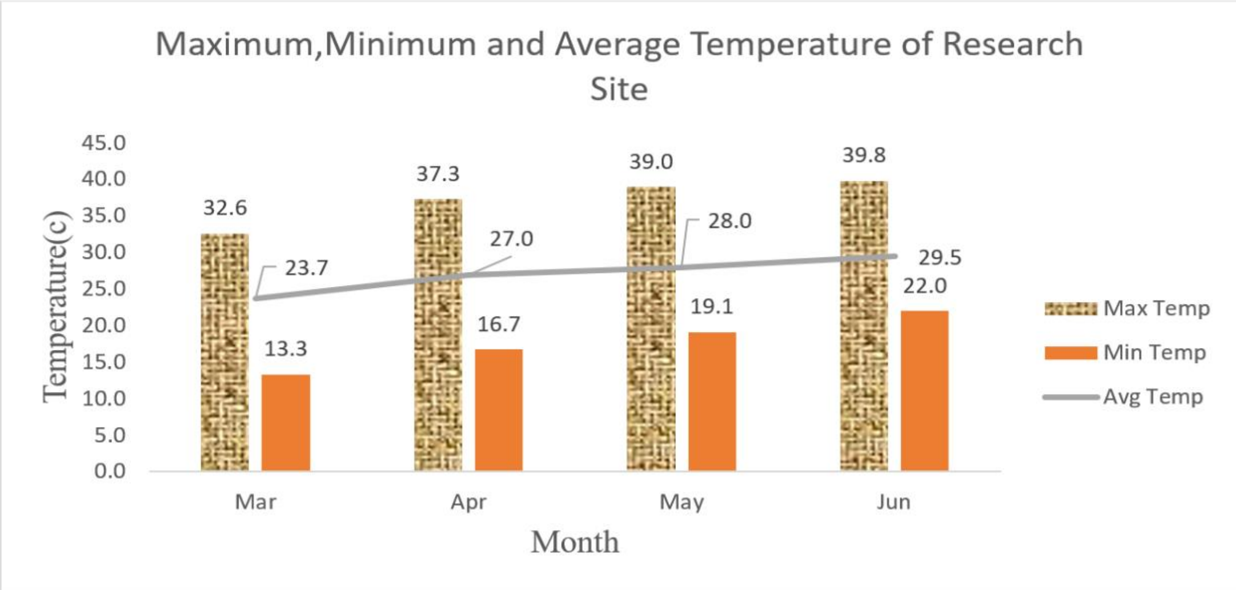

Figure 1: *Maximum, minimum and average temperature of the experimental site (Bhadrapur, Jhapa).*

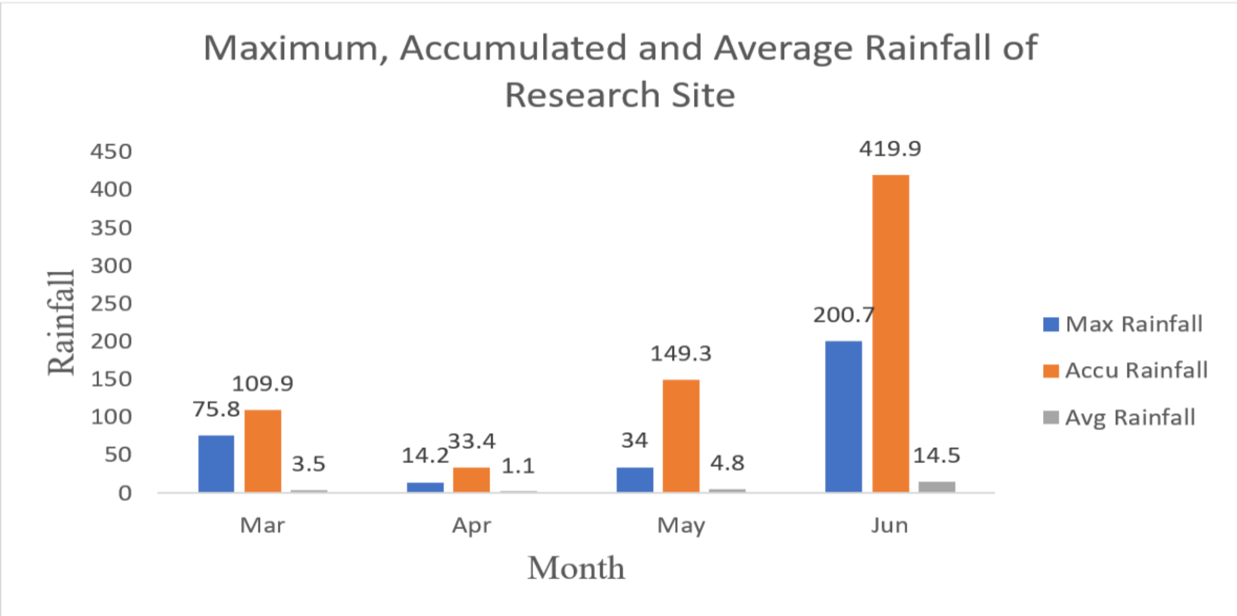

Figure 2: *Maximum, accumulated and average rainfall of the experimental site (Bhadrapur, Jhapa).*

Design of Experiment and Experiment Details

Completely Randomized Block Design (RCBD) was used for the experiment, which had 5 different varieties and 4 different replications. All of the varieties included in the study were commercial maize hybrids created by several international corporations and were gathered from local agrovets in the Bhadrapur area. Rampur Composite was employed as a standard check in the experiment since it is the most widely used open pollinated variety in that region. Table 1 contains specifics on the used varieties. The experimental plots used in the study were $12m^2$ in size (4 meters by 3 meters). The rows of plants were spaced 75 centimeters apart, while the individual plants within each row were spaced 25 centimeters apart. The distance between each block of plots was 1 meter, and the distance between each individual plot was 0.75 meters. The maize seeds were planted on March 4th, and the harvest took place on June 27th after the maize plants reached physiological maturity.

Table 1. *Details of the varieties used in the study.*

Treatment code	Varieties Name	Company
1	Rampur Composite	Thai compsite-1+ Suwan-1
2	Rampur Hybrid 10	RML-150/RML-18
3	Pioneer 3396	DuPont Pioneer
4	All rounder	Local Agrovet
5	CP 808	Charoen Popkhand Seeds Pvt. ltd.

Crop Management Practices

The experimental area was prepared for cultivation by ploughing it twice and then leveling it. During the field preparation, farmyard manure was added. Fertilizers, consisting of urea, diammonium phosphate (DAP), and muriate of potash (MOP) were applied at a rate of 120:60:40 NPK kg/ha. The seed was used at the rate of 20-25 kg/ha. When sowing the seeds, phosphorus and potassium were applied as a basal dose, while only half of the nitrogen was applied. The remaining half of the nitrogen was split into two applications, one at the knee-high stage and the other at the pre-tasseling/silking stages. Additionally, earthing up was performed at the knee- high stage.

Data collection

Data collection involved selecting ten plants at random from all plots. The observations recorded included various aspects related to yield and yield components, such as the height of the plant (in centimeters), the length and diameter of the cop (in centimeters), number of rows per cop, the number of grains per row, the number of days it took for 50% taselling to occur, the number of days it took for 50% silking to occur, the time interval between anthesis and silking, the weight of one thousand kernels (in grams), and the grain yield per hectare (in tons). Upon harvesting, all the ears from each plots were gathered. The length and diameter of the cob, as well as the number of rows per cop and the number of grains per row, were recorded. To determine the grain yield, the total harvested ears per plot (field weight) were weighed, taking into account the grain moisture content in the field. Additionally, the thousand kernel weight was measured and later adjusted to account for a moisture content of 12.5%. The formula used for calculating grain yield and thousand kernel weight is given below in equation 1 and equation 2 respectively which were also used by Thapa et al., (2022) to adjust the grain yield (tons/ha) at 15% moisture content.

$$\text{Grain yield (tons/ha)} = \frac{\text{F.W. (kg/plot)} \times (100 - \text{HMP}) \times \text{S} \times 10000}{(100 - \text{DMP}) \times \text{NPA} \times 1000} \quad \text{(Eq. 1)}$$

Where,

F.W. = Fresh weight of ear in kg per plot at harvest

HMP = Grain moisture percentage at harvest

DMP = Desired moisture percentage, i.e., 15%

NPA = Net harvest plot area, m^2

S = Shelling coefficient, i.e., 0.8

$$\text{1000-kernel weight} = \frac{\text{Kernel weight} \times (100 - \text{moisture \%})}{100 - 12.5} \quad \text{(Eq. 2)}$$

Statistical analysis

For both replication and treatment blocks, raw data were input using MS Excel 2021 (Microsoft Corporation, Washington, USA) chronologically. Then, using statistical software (R Studio, Version 4.2.2, Boston, Massachusetts, USA), analysis of variance (ANOVA) was performed. Duncan's Multiple Range Test (DMRT) was used to compare mean values among different treatments at a significant level of 5%. Multiple correlation analysis, Coefficient of determination (R^2), linear regression equation, and scatter diagram showing the fitted simple regression line of $\hat{Y}$ (Yield) on X was also performed.

RESULTS and DISCUSSION

Analysis of variance

The study's ANOVA results (Tables 2 and 3) indicate significant differences in phenological traits (anthesis and silking days), growth parameters (plant height, cob length, and cob diameter), yield components (thousand grain weight, number of rows per cob, grains per row), and grain yield. Plant height ranged from 174.32 cm to 220.72 cm, while cob length and diameter varied between 18.01 cm to 22.64 cm and 13.85 cm to 15.56 cm, respectively. The time span between anthesis and silking was observed to range from 3.5 to 6.5 days. Thousand grain weights ranged from 291.25 g to 321.25 g per 1000 kernels, with an average of approximately 303.09 g/1000 kernels. The average recorded grain yield was 5.69 t/ha.

Table 2: *Analysis of hybrids for agronomic traits at Bhadrapur, Jhapa.*

Varieties	PH	CL	CD	NORPC	NOGPR	DTT	DTS	ASI	TW	Yield
Rampur Composite	178.62^{c}	18.01^{c}	14.10^{cd}	11.84^{d}	29.23^{c}	67.25^{b}	73.75^{ab}	6.50^{a}	300.00^{a}	5.39^{bc}
Rampur Hybrid 10	174.32^{c}	20.14^{b}	13.85^{d}	12.86^{c}	33.18^{bc}	72.75^{a}	76.75^{a}	4.00^{b}	321.25^{a}	4.32^{c}
Pioneer 3396	220.72^{a}	21.01^{ab}	15.56^{a}	15.45^{a}	37.37^{ab}	69.00^{ab}	73.25^{b}	4.25^{b}	291.25^{a}	6.17^{ab}
All rounder	196.70^{b}	19.41^{bc}	15.02^{ab}	14.55^{ab}	35.96^{ab}	69.75^{ab}	73.50^{ab}	3.75^{b}	303.75^{a}	5.82^{b}
CP 808	218.05^{a}	22.64^{a}	14.75^{bc}	13.89^{b}	40.10^{a}	69.50^{ab}	73.00^{b}	3.50^{b}	300.00^{a}	7.18^{a}
Grand mean	197.68	20.24	14.65	13.71	35.17	69.65	74.05	4.4	303.25	5.78
CV (%)	5.25	5.57	3.31	4.63	10.89	3.62	2.73	22.24	12.66	12.14
SEM (±)	5.82	0.42	0.19	0.32	1.20	0.61	0.47	0.31	8.23	0.25
F value	17.18***	9.45**	8.10**	19.68***	4.69*	2.47^{NS}	2.30^{NS}	6.07**	0.33^{NS}	8.92**

PH: Plant height, CL: Cob length, CD: Cob diameter, NORPC: Number of rows per cob, NOGPR: Number of grains per row, DTT: Days to 50% tasseling, DTS: Days to 50% silking, ASI: Anthesis silking interval, TW: Test weight, CV: Coefficient of variation; SEM: Significant error of Mean; *Significant at 5% level of significance, **Significant at 1% level of significance, ***Significant at 0.1% level of significance, ^{NS}Non-significant

Table 3: *Summary statistics of different agronomic traits in studied hybrids*

	PH	CL	CD	NORPC	NOGPR	DTT	DTS	ASI	TW	Yield
N	5	5	5	5	5	5	5	5	5	5
Min	174.32	18.01	13.85	11.84	29.23	67.25	73	3.5	291.25	4.32
Max	220.72	22.64	15.56	15.45	40.1	72.75	76.75	6.5	321.25	7.18
Sum	988.41	101.21	73.28	68.59	175.84	348.25	370.25	22	1516.25	28.88
Std .error	9.63	0.77	0.30	0.63	1.85	0.88	0.68	0.53	4.94	0.46
Variance	463.92	3.00	0.47	1.99	17.25	3.95	2.35	1.45	122.34	1.09
Stand .dev	21.53	1.73	0.69	1.41	4.15	1.98	1.53	1.20	11.06	1.04
Median	196.70	20.14	14.75	13.89	35.96	69.50	73.50	4.00	300.00	5.82
25 percentiles	176.47	18.71	13.97	12.35	31.20	68.12	73.12	3.62	295.62	4.85
75 percentiles	219.38	21.82	15.29	15.00	38.73	71.25	75.25	5.37	312.50	6.67
Skewness	0.04	0.20	0.11	-0.21	-0.50	0.83	2.05	1.94	1.24	-0.11
Kurtosis	-2.86	0.12	-1.45	-0.95	-0.12	2.03	4.35	3.97	2.51	0.71
Geom. mean	196.74	20.18	14.64	13.65	34.96	69.62	74.03	4.28	303.09	5.69

PH: Plant height, CL: Cob length, CD: Cob diameter, NORPC: Number of rows per cob, NOGPR: Number of grains per row, DTT: Days to 50% tasseling, DTS: Days to 50% silking, ASI: Anthesis silking interval, TW: Test weight

Phenological traits

The study found notable differences among maize varieties in terms of their phenological traits, particularly in tasseling and silking stages which was presented in figure 6. Rampur Composite exhibited the earliest tasseling, reaching 50% tasseling in 67.25 days, followed closely by Pioneer 3396 (69 days), CP 808 (69.50 days), and All Rounder (69.75 days). In contrast, Rampur Hybrid 10 showed delayed tasseling, achieving 50% tasseling after 72.75 days. On average, all varieties reached 50% tasseling in approximately 69.65 days, with no statistically significant differences observed. For 50% silking, CP 808 showed the earliest timing at 73 days, followed closely by Pioneer 3396 (73.25 days), All Rounder (73.50 days), and Rampur Composite (73.75 days). Rampur Hybrid 10 again exhibited delayed silk at 76.75 days. The average time to reach 50% silking across all varieties was 74.05 days, with no significant differences noted. However, significant variability was observed in the anthesis-silking interval among the varieties. Rampur Composite had the longest interval (6.50 days), followed by Pioneer 3396 (4.25 days), Rampur Hybrid 10 (4.00 days), All Rounder (3.75 days), and CP 808 with the shortest interval (3.50 days). This difference was highly significant ($p<0.01$), with an overall mean anthesis-silking interval of 4.4 days. Previous studies (Thapa et al., 2022; Kandel & Shrestha, 2020) have similarly documented variability in flowering and silking times among maize hybrids. They also noted that a longer anthesis-silking interval can lead to fertility issues, poor kernel fill, and reduced grain yield. Anthesis silking interval, which is the time gap between tasseling and silking, showed significant variability among the varieties. Rampur Composite had the highest anthesis interval (6.50), followed by Pioneer 3396 (4.25), Rampur Hybrid 10 (4.00), All Rounder (3.75), and the lowest anthesis interval was in CP 808 (3.50). The differences in anthesis silking interval among the varieties were highly significant ($p<0.01$). The overall mean anthesis silking interval for all the varieties was found to be 4.4. The greater the time difference between tasseling and silking stages, the more likely it is to experience infertility issues, kernels not being filled on the cob, and finally a decline in grain yield has been reported by Thapa et al.,(2022).

Growth traits

The research findings indicate significant variations in plant height, cob length, and cob diameter among different maize varieties studied. The overall mean plant height across all varieties was 197.68 cm. Notably, Pioneer 3396 (220.72cm) and CP 808 (218.05 cm) exhibited the tallest plant heights, followed closely by All-rounder (196.70 cm) and the earlier discoveries made by Thapa et al., (2022) also added support to this assertion. On the other hand, Rampur Composite and Rampur Hybrid 10 had comparatively shorter plant heights, measuring 178.62cm and 174.32 cm, respectively. These results are consistent with Bahadur Kunwar & Shrestha (2014) research, which also found that different hybrids varied in plant height. Genetic factors are responsible for the discrepancy in plant height since they control the growth traits of each variety, which causes it. Regarding cob length, the overall mean across all maize varieties was 20.24 cm. The data revealed highly significant differences (<0.01) in cob length among the different varieties. CP 808 exhibited the longest cob length at 22.64 cm, followed by Pioneer 3396 (21.01 cm) and Rampur Hybrid 10 (20.14 cm). Conversely, All-rounder and Rampur Composite showed the shortest cob lengths, measuring 19.41 cm and 18.01 cm, respectively. Our findings regarding plant height and cob length align closely with the results of a prior study conducted in the inner plains of Nepal by Kandel & Shrestha,(2020). Cob diameter also displayed significant variability among the maize varieties. The overall mean cob diameter was 14.65 cm. Pioneer 3396 had the largest cob diameter at 15.56 cm, while All rounder and CP 808 followed closely with diameters of 15.02 cm and 14.75 cm, respectively. Rampur Composite had an average cob diameter of 14.10 cm, and Rampur Hybrid 10 exhibited the smallest cob diameter at 13.85 cm. In summary, the research results highlight the substantial impact of maize variety on plant height, cob length, and cob diameter, indicating the importance of selecting the right variety to achieve desired growth characteristics.

Yield and yield component traits

The research findings revealed significant differences (<0.001) in the number of rows per cob among the maize varieties studied, consistent with prior studies by Kandel & Shrestha (2020) and Thapa et al. (2022). Pioneer 3396 exhibited the highest number of rows per cob (15.45), followed by All Rounder (14.55) and CP 808 (13.89). In contrast, Rampur Hybrid 10 and Rampur Composite had fewer rows per cob, measuring 12.86 and 11.84, respectively. The overall mean number of rows per cob across all varieties was 13.71. Regarding grains per row, CP 808 showed the highest count (40.10 grains), followed by Pioneer 3396 (37.37) and All Rounder (35.96). Rampur Hybrid 10 averaged 33.18 grains per row, while Rampur Composite had the lowest count (29.23 grains). The differences in grains per row were significant (<0.1) among the maize varieties studied, consistent with findings reported by Thapa et al. (2022). Test weight did not significantly differ among the varieties, with an overall average of 303.25 grams. Rampur Hybrid 10 exhibited the highest test weight (321.25 grams), followed by All Rounder (303.75 grams), and Rampur Composite and CP 808 had identical weights (300 grams), while Pioneer 3396 had the lowest (291.25 grams). Grain yields varied significantly among the varieties ($p < 0.001$), with an overall mean of 5.78 tons/ha. CP 808 achieved the highest yield (7.18 tons/ha), followed by Pioneer 3396 (6.17 tons/ha), and All Rounder (5.82 tons/ha). Rampur Composite recorded an average yield of 5.39 tons/ha, while Rampur Hybrid 10 had the lowest (4.32 tons/ha). The study highlighted that taller plant height correlated with increased yield due to enhanced photosynthetic surface area and nutrient absorption, consistent with findings by Bahadur Kunwar & Shrestha (2014).

Correlation of grain yield with yield attributing traits

The findings show that plant height (r=0.53), cob length (r=0.47), number of grains per row (r=0.50), number of rows per cob (r=0.39), and cob diameter (r=0.43 are all positively and significantly correlated with grain yield. Anthesis days (r=-0.40) and silking days (r=-0.62), on the other hand, have a negative and significant correlation with grain yield which is presented in figure 4. As a result, cultivars having longer days between tasseling and silking typically have lower grain yields. Therefore, it is advisable to choose a hybrid with fewer days till anthesis. These results are consistent with earlier research of Thapa et al. (2022) and Kandel & Shrestha (2020) that found grain yield to be favorably correlated with cob attributes and negatively correlated with reproductive traits. Additionally, the ASI (Anthesis- Silking Interval) showed a negative and non -significant correlation with grain yield. This implies that if the ASI is longer in the crop, it promotes vegetative growth, leading to lower grain yield. The results of Thapa et al. (2022), which indicated a positive correlation between the ASI and grain yield, are interestingly at odds with this discovery but was similar to the findings of Neupane et al. (2020).

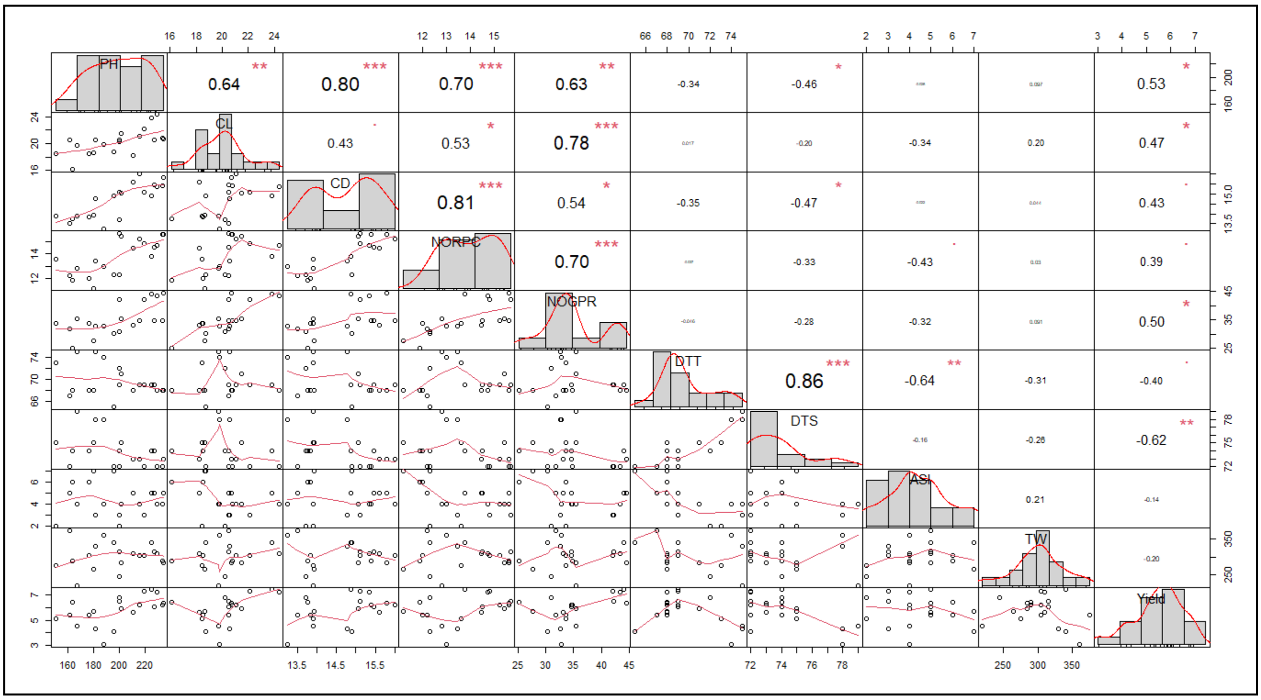

Figure 4: Multiple correlation analysis [PH: Plant height, CL: Cob length, CD: Cob diameter, NORPC: Number of rows per cob, NOGPR: Number of grains per row, DTT: Days to 50% tasseling, DTS: Days to 50% silking, ASI: Anthesis silking interval, TW: Test weight, *Significant at 5% level of significance, **Significant at 1% level of significance, ***Significant at 0.1% level of significance, ˙Significant at 10% level of significance].

Regression of yield and yield attributing traits

Figure 5 displays about Coefficient of determination (R^2), linear regression equation, and scatter diagram showing the fitted simple regression line of $\hat{Y}$ (Yield) on X. The relationship between plant height (in cm) and yield (in t/ha) is shown in Graph (a), illustrating that as plant height rises, so does yield. A yield increase of 0.023 (t/ha) is produced for every 1cm increase in plant height. The link between cob length and yield is shown in Graph (b), showing that as cob length grows, so does yield. The yield rises by 0.29 (t/ha) for every 1cm that the cob length increases. A similar link between cob diameter and yield is shown in graph (c). It demonstrates that higher cob diameter results in higher yield. The yield rises by 0.58 (t/ha) for every 1cm increase in cob diameter. The outcomes of graph (d) and (e) indicate a direct relationship between grain yield and the number of rows per cob as well as the number of grains per row. As the number of rows per cob and grains per row increases, the yield also increases. Additionally, each additional row per cob leads to a yield increase of 0.31 (t/ha), while each extra grain per row results in a yield increase of 0.1 (t/ha). The graph (f) show the association between yield and the number of days needed for 50% tasseling, whereas the graph (g) shows the relationship between yield and the time needed for 50% silking. According to these graphs, the yield falls as the number of days to 50% tasseling rises. Additionally, the yield will drop by 0.17 tons per hectare (t/ha) for each extra day it takes for 50% of the tasseling to occur. The yield also drops as the number of days to 50% silking rises. The yield will fall by 0.33 tons per hectare (t/ha) for every extra day it takes for 50% silking to happen. The anthesis-silking interval's effect on yield is shown in graph (h), which shows that the yield declines as the interval widens. More specifically, the yield falls by 0.12 tons per hectare (t/ha) for every additional unit of the anthesis-silking interval. The graph (i), on the other hand, illustrates the relationship between yield and test weight, showing that the yield declines as the test weight rises. More specifically, the yield falls by 0.0062 tons per hectare (t/ha) for every 1 gram rise in test weight.

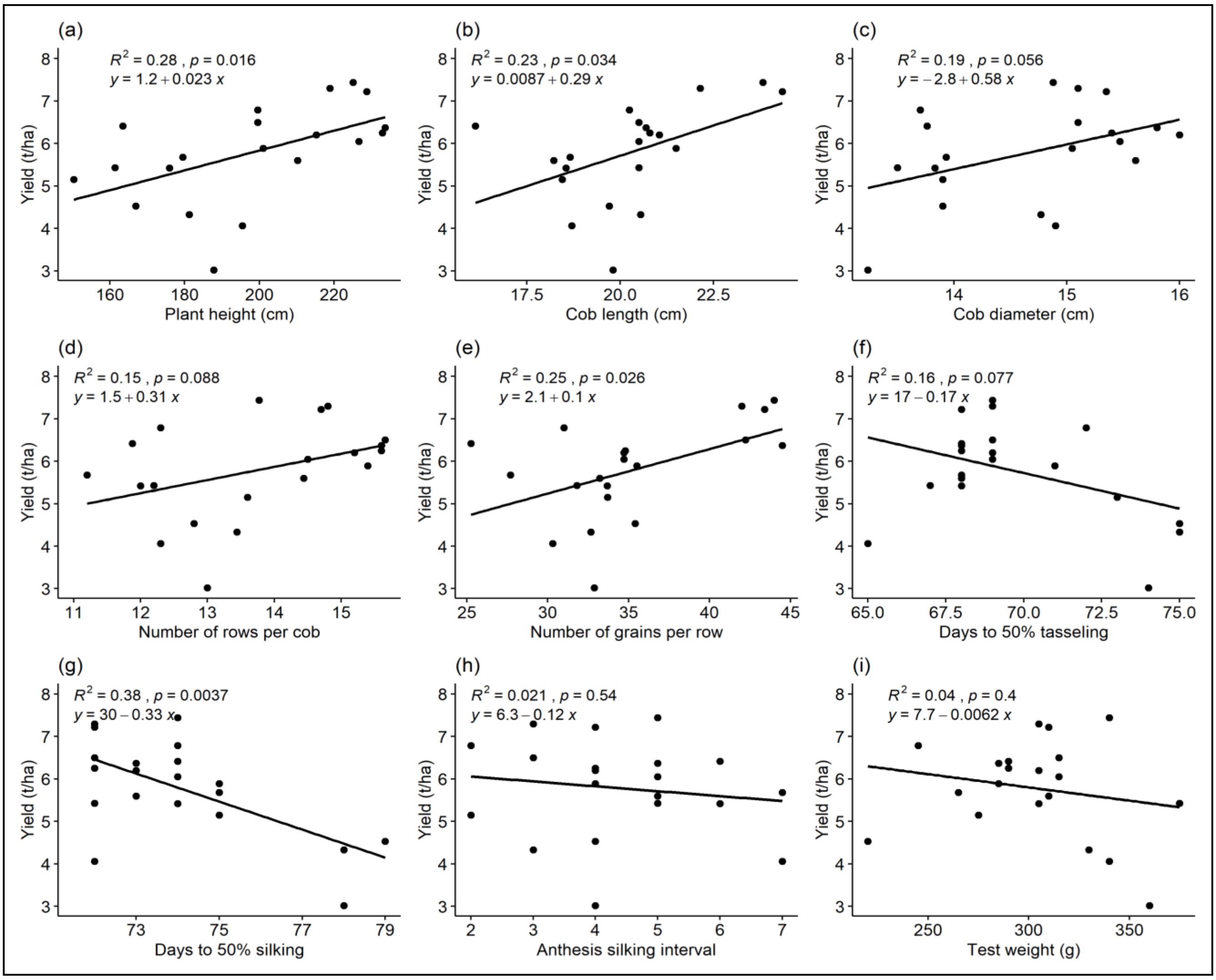

Figure 5: Coefficient of determination (R^2), linear regression equation, and scatter diagram showing the fitted simple regression line of $\hat{Y}$ (Yield) on X ([a]Plant height, [b]Cob length, [c]Cob diameter, [d]Number of rows per cob, [e]Number of grains per row, [f]Days to 50% tasseling, [g]Days to 50% silking, [h]Anthesis silking interval, [i]Test weight).

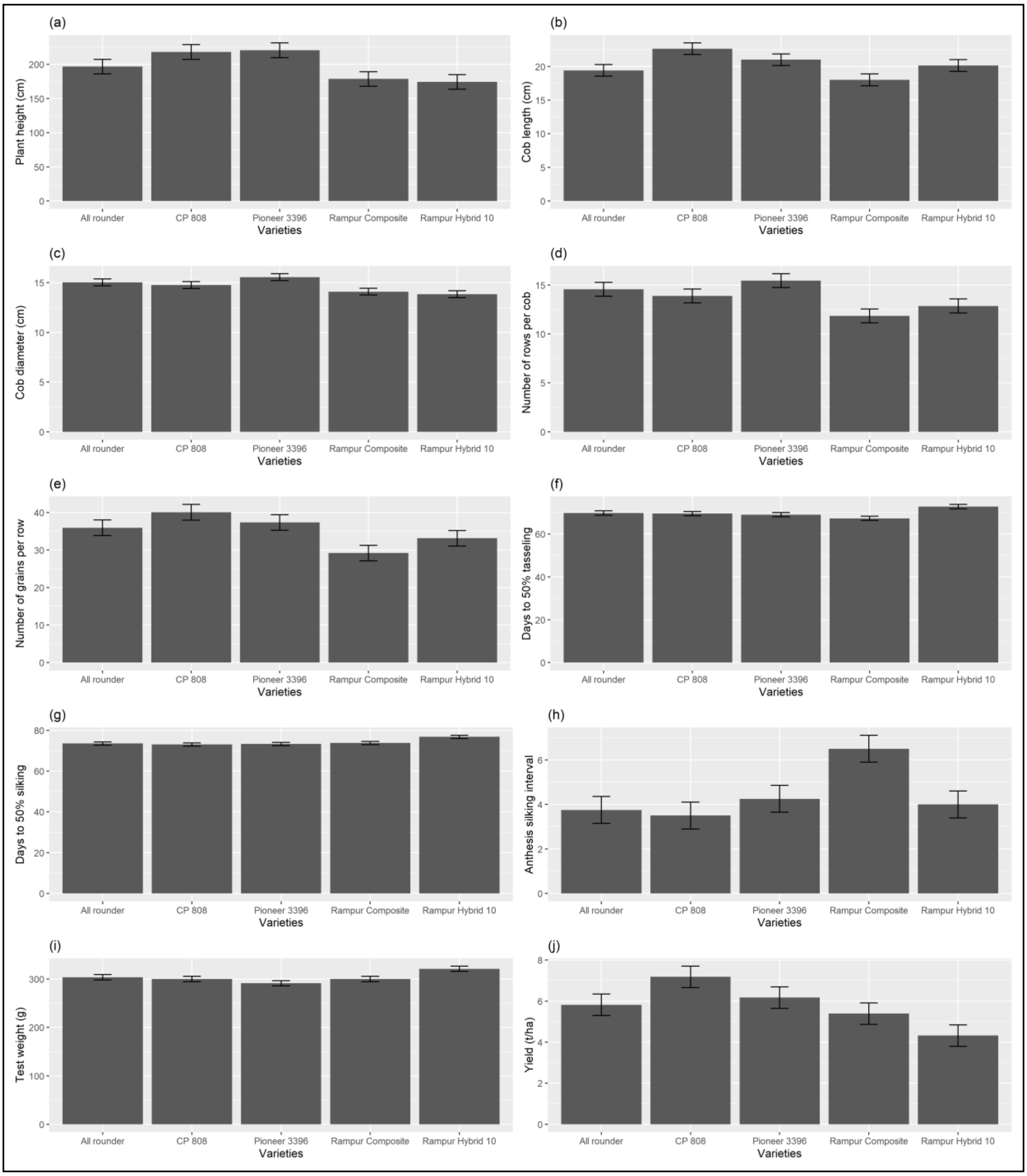

Figure 6: Comparing each trait including [a]Plant height, [b]Cob length, [c]Cob diameter, [d]Number of rows per cob, [e]Number of grains per row, [f]Days to 50% tasseling, [g]Days to 50% silking, [h]Anthesis silking interval, [i]Test weight, and [j]Yield.

CONCLUSION

The study reveals significant genetic diversity among maize hybrids, highlighting CP 808 and Pioneer 3396 as superior performers with consistently high yields. Variability in traits such as grain production, test weight, cob length, diameter, and phenology were observed among the hybrids. Strong positive correlations were found between grain yield and key traits like plant height, grains per row, rows per cob, and cob diameter, indicating their importance in yield enhancement. Given the study's single-season scope, its findings may not universally apply across Nepal. Farmers are encouraged to conduct on-farm evaluations of CP 808 and Pioneer 3396 under various planting and nutrient conditions to optimize productivity and profitability. This practical assessment will validate their performance potential in diverse agro-climatic zones. Future research should extend these findings over multiple seasons to confirm the hybrids' suitability for widespread cultivation and enhance their practical application in agricultural practices.

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AUTHOR CONTRIBUTIONS

Puja YADAV:Conceptualization, funding acquisition, investigation, Data curation,methodology. Dipesh Kumar MEHATA: Conceptualization, funding acquisition, investigation,methodology, resources, software, supervision,writing – review & editing, validation, visualization. Vivek LAHUTIYA: Data curation,methodology, Revision. Bishnu Yadav: Data curation,methodology. Riya ADHIKARI: Data curation,methodology, Revision All authors have read and agreed to the published version of the manuscript.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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