

# Evaluating Performance of Maize hybrids in Terai Region of Nepal

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**Abstract** The replacement of open pollinated varieties by hybrids is an effective way to increase the maize production. The access to hybrid maize is very limited for Nepalese farmers. In order to identify high yielding maize hybrids, eighteen maize hybrids were tested under coordinated varietal trial using randomized complete block design in two replicates in 2007/08 to 2008 /09 during winter seasons at National Maize Research Program, Rampur, Chitwan, Nepal. The results showed that, among studied traits, hybrids exhibited significant differences for tasseling, silking and grain yield in both years. The hybrid namely L3/L2 produced the highest grain yield (7.2 t/ha) followed by L1/L3 (6.4 t/ha) and P UTU-20/AG-27 (5.9 t/ha), respectively. The results indicated that these hybrids were promising; they should be tested under on-farms and promoted for general cultivation in Terai region of Nepal.

**Keywords:** maize hybrid, grain yield and winter season

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## 1. Introduction

Maize (*Zea mays L.*) is the most important crops in the world; it is used mainly for human food, animal feed and industry. It is the second staple food crop for country and first staple food crop for hill regions of Nepal. In Nepal, it is the food for more than 14 million people in the hills and is playing a vital role in the livelihood of rural people. In the changing climatic context, maize will be a leading and life saving crop in Nepal. The productivity of maize in Nepal is very low. Total area under cultivation of maize in Nepal is 870166 ha, which is about 28.15 % of the total cultivated agricultural land while average yield is 2.15 t/ha. It is about 23.28 % of the total cereal production and 6.87 % to Agricultural Gross Domestic Product in Nepal (MOAC, 2007/08). It is well recognized fact that cultivation of hybrids maize cultivars is one of the best alternatives to increase the production and productivity of maize in Nepal. Hybrid maize after rice is being popular among the famers of central and eastern Terai. It also indicates the changing scenario of farmers' preferences towards maize after rice. Most of the winter maize produced in Terai and inner Terai districts is utilized as the raw materials for the poultry feed industries. The ever-increasing trend of poultry business has demanded considerably more amounts of maize grains. Only the cultivation of open pollinated varieties in spring or summer season could not meet the demand of maize grains in the market. Farmers in the boarder districts adjoining to India has been trying to supply maize grains for those industries through growing hybrid maize

cultivars since many years. They are also exploiting hybrid maize as green cobs near to road corridor as cash crop. Thus, hybrid maize has become one of the potential options to fulfill the market demand.

Due to unavailability of hybrid maize as seed, majority of farmers are still growing open pollinated varieties (OPVs) in the Terai region of Nepal. There is a huge potentiality of doubling the current national average yield of maize through exploitation of heterosis. Multi Terai and inner Terai of Nepal is highly potential for hybrid cultivation particularly in spring and winter seasons (Sharma et al., 2004). Hybrid maize breeding in Nepal was initiated since 1987 however, there was no hybrids for farmers except Gaurav released in 2003. This historical hybrid maize cultivar could not become popular among the maize growers due to some constraints in seed production as demanded by the consumer. It shows that farmers have not any varietal options in case of hybrids maize for general cultivation. Therefore this study was conducted at National Maize Research Program, Rampur, Chitwan in 2007/08 to 2008/09 during winter seasons in order to identify high yielding superior hybrids for Terai region of Nepal.

## 2. Materials and Methods

### 2.1. Genetic Materials and Experimental Site

Eighteen maize hybrids namely P UTU-10/Rampur Composite, L3/L2, P UTU-9/AG-27, PUTU-2/Rampur Composite, L2/L1, P UTU-19/AG-27, AG-29/Pool-17, PUTU-17/AG-27, PUTU-12/AG-27, PUTU-10/Arun-2,

L1/L3, L7/L6, AG-20/Pool-17, PUTU-20/AG-27, PUTU-4/Rampur Composite along with three check hybrids; Gaurav, Rajkumar, Pioneer30G10 were used in these experiments. The geographical location of the trials was

27° 37' N latitude, 84° 25' E longitude at an altitude of 256 meter above sea level and has a sub tropical climate (Thapa and Dangol, 1988).

**Table 1. Meteorological data during trials (from September 2007 to December 2009 February) at National Maize Research Program, Rampur, Chitwan, Nepal**

Month	Average maximum temperature (°C)	Average minimum temperature (°C)	Rainfall (mm)	Relative humidity (%)
September (2007)	32.5	24.38	926.7	89.3
October	32.3	21.4	120.2	89.5
November	29.7	13.8	4.6	92.2
December	24.4	8.9	0	99.6
January (2008)	22.3	8.48	17.1	74.91
February	24.3	7.64	1.7	96.24
September	33.1	24.3	218.7	86.8
October	31.4	19.7	87.3	89.4
November	28.2	13.7	0	94.7
December	23.9	12.1	0	97.5
January (2009)	23.4	10	0	98.6
February	27.8	10.2	0.1	93.5
Average	27.78	14.55	1376.40 (total)	91.85

## 2.2. Experimental Design and Crop Husbandry

The trials were conducted under coordinated varietal trial at the National Maize Research Program, Rampur, Chitwan, Nepal during September to February, 2007/08-2008/09. The experimental design was randomized complete block design (RCBD) with two replications in both years. The plot size was 4 rows of 5 m length with spacing of 75 cm x 25 cm (RR x PP) and all plots were fertilized with 160:60:40 N :P<sub>2</sub>O<sub>5</sub> :K<sub>2</sub>O kg/ha in the form of urea, di-ammonium phosphate (DAP), and murate of potash (MoP). Of this 50 % of nitrogen, full 100% of phosphorous and potassium fertilizers were applied as basal and remaining 50 % of nitrogen was split first at knee high stage (top dressing) and second at tasseling stage (side dressing). Thinning was done at 25<sup>th</sup> day after sowing (DAS) to maintain a single plant per hill. Furadon (3 % C.G) 2-3 granules per plant of maize was applied against the stem borer to the uppermost whorls of leaves at the grand growth stage (40 DAS). Two manual weeding were done throughout the maize growing period, first at knee-high (25 DAS) and second at tasseling stage (55 DAS). Irrigations was done two times during the growing period of maize hybrids, first at grand growth stage (40 DAS) and second at tasseling stage (60 DAS).

## 2.3. Data Recording, Measurements and Analysis

The observation on days to 50% tasseling, days to 50% silking, plant height, ear height and grain yield was taken. Ten plants in each subplot (harvested plot) after harvesting were randomly selected; their ear lengths were measured with the help of measuring tap. The data generated were averaged to record ear length. Ears harvested for grain yield were used for the determination of number of grains/ear by selecting ten ears randomly from each subplot, dried (around 15% moisture) and shelled (80% shelling) for grains/ear. Data regarding thousand grains weight were recorded by counting randomly selected 1000

grains from each sub plot and weighed with sensitive electronic balance. The grain yield (kg/ha) was recorded by weighing the grains shelled from the ears obtained from the central four rows of each subplot and converted it into kg/ha using the formula:

$$\text{Grain yield (kg / ha)} = \left\{ \text{Grain yield (kg) / Area harvested (7.5m}^2 \right\} \times 10000$$

Data were analyzed using the statistical package MSTAT-C (Russel and Eisensmith, 1983) and the significant differences between treatments were determined using least significant difference (LSD) test at probability level of 0.01 or 0.05 where the effects of the treatments were significant at 1% or 5% level of probability, respectively.

## 3. Results and Discussion

Flowering is important factor contributing to grain formation in maize. In 2007/08, days to 50% tasseling ranged from 54-78 days which was significantly different. Similarly in second growing season (2008/09 winter), it ranged from 52-66 days which was significant. The days to 50% silking varied from 54-76 days that was significant different in 2007/08 winter. In 2008/09, it was observed from 55-70 days that was significant.

Plant height is a genetically as well as environmentally controlled factor and different hybrids have different plant height. In 2007/08, the height of the plants was ranged from 152-225 cm and mean height is 195 cm. Similarly, in 2008/09, plant height differed from 130- 207 cm and mean height 178 cm. These results are in accordance with the results of Ali (1994) who also reported difference of plant height in different hybrids. This was due to the fact that plant height is a genetically controlled factor so the height of different varieties does not remain equal. As for the effect of environmental factors on plant height is concerned it could not be neglected but the selection of proper crop cultivar manages the influence of environment.

Ear height is one of the most desirable traits in maize. Positioning of the ear above the middle of the plants often leads to lodging. The ear height of tested hybrids varied from 97-120 cm which was non-significant level on 2007/08 winter. Similarly in 2008/09 winter, the ear height was observed from 62-100 cm which was not significant.

Grain yield of a crop is the ultimate objective of all the research of grain crops. Data in the table indicated that

maize hybrid varied significantly for grain yield. The analysis revealed that hybrids differ for grain yield and other traits (Table 2 and Table 3). The hybrids PUTU-19/AG-27, PUTU-20/AG-27, Gaurav, L-3/L-2, L-1/L-3 and P UTU-9/AG-27 produced highest grain yield 12.911, 10.175, 8.618, 7.205, 6.391 and 5.572 t/ha respectively. These results are in line with those of McCutcheon et al. (2001), who reported significant differences among maize cultivars for grain yield.

**Table 2. Agronomic performance of maize hybrids at National Maize Research Program Rampur, Chitwan, Nepal in 2007/08 winter season**

S.N.	Hybrids	50% Tasseling days	50% Silk in g days	Plant height (cm)	Ear height (cm)	Grain yield (t/ha)
1	PUTU-10/Rampur Composite	68.0	71.0	205.0	100.0	6.0
2	L3/L2	73.5	76.5	180.0	100.0	8.4
3	PUTU-9/AG-27	73.0	76.0	210.0	107.5	6.5
4	PUTU-2/Rampur Composite	68.5	71.5	220.0	112.5	6.5
5	L2/L1	67.0	70.0	220.0	120.0	8.5
6	PUTU-19/AG-27	77.0	80.0	205.0	110.0	12.9
7	AG-29/Pool-17	65.0	68.0	225.0	110.0	7.1
8	PUTU-17/AG-27	78.5	81.5	210.0	110.0	7.8
9	PUTU-12/AG-27	78.0	81.0	152.5	90.0	7.3
10	PUTU-10/Arun-2	64.5	67.5	195.0	97.5	6.0
11	L1/L3	78.5	82.0	200.0	100.0	6.6
12	L7/L6	75.5	78.5	152.5	92.5	5.6
13	AG-20/Pool-17	54.5	57.5	190.0	95.0	6.7
14	PUTU-20/AG-27	70.0	73.0	170.0	92.5	10.2
15	PUTU-4/Rampur Composite	67.0	70.0	215.0	112.5	6.4
16	Gaurav	76.0	79.0	200.0	97.5	8.6
17	Rajkumar	72.0	76.0	205.0	100.0	4.1
18	Pioneer30G10	76.0	79.0	165.0	92.5	5.8
	Grand mean	71.25	74.333	195.556	102.222	7.279
	CV, %	5.08	5.01	12.99	15.10	24.29
	F-test	*	*	ns	ns	*
	LSD0.05	7.638	7.861	53.600	32.565	3.730

**Table 3. Agronomic performance of maize hybrids at National Maize Research Program, Rampur, Chitwan in 2008/09 winter season**

S.N.	Hybrids	50% Tasseling days	50% Silking days	Plant height (cm)	Ear height (cm)	Grain yield (t/ha)
1	PUTU-10/Rampur Composite	52.5	56.5	160.0	80.0	4.3
2	L3/L2	60.5	64.0	192.5	95.0	7.2
3	PUTU-9/AG-27	60.0	63.0	180.0	100.0	5.6
4	PUTU-2/Rampur Composite	61.5	64.5	197.5	92.5	5.3
5	L2/L1	61.5	65.0	175.0	97.5	5.3
6	PUTU-19/AG-27	59.0	62.0	160.0	85.0	5.6
7	AG-29/Pool-17	57.5	60.5	207.5	97.5	4.1
8	PUTU-17/AG-27	55.0	55.5	195.0	97.5	5.4
9	PUTU-12/AG-27	56.5	59.5	192.5	95.0	5.7
10	PUTU-10/Arun-2	59.0	62.0	167.5	90.0	5.3
11	L1/L3	63.0	66.5	162.5	72.5	6.4
12	L7/L6	63.5	66.5	130.0	62.5	3.0
13	AG-20/Pool-17	52.5	55.5	175.0	75.0	4.9
14	PUTU-20/AG-27	59.5	63.0	172.5	85.0	5.9
15	PUTU-4/Rampur Composite	59.0	62.0	195.0	97.5	4.9
16	Gaurav	58.0	61.0	190.0	92.5	5.4
17	Rajkumar	53.0	60.5	182.5	82.5	5.7
18	Pioneer30G10	66.5	70.0	170.0	77.5	0.4
	Grand mean	58.77	50.417	178.056	87.50	5.023
	CV, %	8.29	15.82	12.50	19.15	18.85
	LSD0.05	10.275	20.186	47.315	35.349	1.999
	F-test	*	*	ns	ns	*

## 4. Conclusion

Evaluation of hybrid maize is important task for hybrid development program. The observed variation on plant height and ear height were non significant but tasseling and silking along with grain yield were significantly differed among the tested hybrids in both years. The hybrids namely PUTU-19/AG-27, PUTU-20/AG-27, L-3/L-2, L-1/L-3 and P UTU-9/AG-27 were found superior hybrids in terms of grain yield, so they should be promoted and tested on farms before release and recommendation for general cultivation in Terai region of Nepal.

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