On-farm evaluation of hybrid maize (*Zea mays* L.) in different ecology of Nepal

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Keshab Babu Koirala^{*1} , Jagat Bandhu Adhikari¹, Mahendra Prasad Tripathi¹

Article Info

Accepted:
30 Sep. 2020

Keywords:

Genotype diversity,
On-Farm trial,
Hybrid maize,
Stability, Yield

ABSTRACT

The increasing demand for maize in Nepal can only be met by growing high yielding hybrids. The best selection of appropriate genotypes for given ecology can contribute to boosting up the total production. To identify suitable hybrids for the mid-hills and Terai region, series of coordinated farmers' field trials and demonstrations were carried out at respective eco-zones of Nepal for three consecutive years from 2016/17 to 2018/19. Six to eight promising single cross hybrids developed by the National Maize Research Program were evaluated with P3533, Rajkumar, and CP808 as commercial checks. The experiments were laid out in randomized complete block design. Pakhribas, Kabre, Khumaltar, Lumle, Salyan, Surkhet, and Dailekh represented the mid-hill and Maharanihoda, Tarahara, Belachapi, Sagarnath, Dumarwana, Parawanipur, Rampur, and Nepalgunj represented the Terai and inner Terai. CP808 and CAH1715 produced a higher grain yield of 8122 and 7566 kg ha⁻¹ at mid-hills and Terai, respectively under coordinated farmers' field trials. RML-86/RML-96 out-yielded with a grain yield of 7319 kg ha⁻¹ in the demonstration at Terai in 2018/19. Based on two to three years' yield data across different eco-zones of Nepal, it was concluded that the Nepali hybrids mainly RML-95/RML-96, RML-86/RML-96, and Rampur Hybrid-6 can produce an average yield more than 6700 kg ha⁻¹. Experimental results showed that RML-95/RML-96 and RML-86/RML-96 were most stable for grain yield in the mid-hill while in Terai and inner Terai, P3396 and Rampur Hybrid-10 showed good stability. These results indicate the expanding scope of such hybrids across the respective eco-zones.

INTRODUCTION

Maize (*Zea mays* L.) is the second most important cereal crop in terms of area (9,40,886 ha) and production (26,53,243 t) with a productivity of 2.82 t ha⁻¹ (MoALD 2020) in Nepal. It contributes about 3.15% in National Gross Domestic Products (GDP) and 9.5% in Agricultural GDP. It occupies 27.39% area of the total food crops and contributes 24.97% to the total cereal production. Domestic production of maize, due to the fast-growing poultry and dairy industries, does not meet national feed demand. Maize demand has increased by 5% annually in the last decade (Sapkota and Pokhrel 2010), whereas the feed demand is increasing at the rate of 11%. This increasing trend of poultry and

livestock business along with increasing population has demanded more maize in the country. Guragain (2019) in his article stated the report of Statistics of trade and export promotion center i.e. 2.92 billion metric tons of maize that worth Rs 71.2 billion, have been imported from India from July 2009 to June 2019. In the fiscal year 2017/18, maize worth of Rs 12 billion was imported from different countries. A huge import is from India. Besides India, Nepal imports maize from Argentina, Brazil, Bangladesh, Myanmar, UAE, America, and China. Nepal's maize import has increased substantially since 1968 to 2017 (Knoema 2019a,b). The total annual demand for yellow maize for poultry feed is 545,268 t. National production fulfills only 30% of this requirement, and rest is supplied by importing from other countries (Bhattarai 2020; Panday 2019). Timsina et al. (2016) and Ghimire et al. (2018) concluded that due to increased demand for yellow maize for poultry and animal feed, the

¹ National Maize Research Program (NMRP), Rampur, Chitwan, Nepal

* E-mail: koiralakb15@gmail.com

maize utilization pattern in the mid-hills of Nepal is being shifted from food to feed. Nepal annually imports maize not only for a feed but around 2000 t of maize for hybrid seed as reported by Dawadi in Kathmandu Post (Paudel 2020).

These circumstances have created the utmost necessity for producing high yielding maize hybrids to fulfill the national requirement. To be self-sufficient in maize, the present national average productivity of 2.82 t ha⁻¹ should be raised to 4 t ha⁻¹. For this, the present seed replacement rate (SRR) of 17.83% (Memoire 2017) should reach to 33% (SQCC 2013). Out of the total maize area in the country, hybrids and open-pollinated varieties (OPVs) occupy 12-15, and 85-88%, respectively (Koirala 2020a). Our local landraces and OPVs cannot meet the ever-rising demand (Koirala et al. 2020b). To date five and two maize hybrids have been released and registered, respectively. Among them, only Khumal Hybrid-2 has been released for mid-hills and rest four along with this Khumal Hybrid-2 for Terai, inner Terai, and river basin areas. Gaurav, Rampur Hybrid-2, Khumal Hybrid-2, Rampur Hybrid-4, Rampur Hybrid-6 are the released, and Rampur Hybrid-8 and Rampur Hybrid-10 are registered single cross yellow kernel hybrids (Koirala 2017). Therefore, hybrid maize is one of the options of breaking the present scenario of maize import. Adoption of modern maize hybrids, characterized by higher-yielding genetic potential with good quality and profitability, is the utmost necessity in current Nepali agriculture.

Co-ordinated farmers' field trials (CFFT) and field demonstrations are the best practices for evaluation and recommendation of any technology including promising pipeline genotypes for their promotion and wider dissemination to bring substantial impacts in the wider farming community. In this approach, farmers are directly involved from sowing to harvesting. It will provide the opportunity to assess the performance of each of the tested hybrids under a wider range of agro-ecological and crop husbandry conditions (representative of those to be faced if the technology is adopted by farmers) and will enable researchers to move research from description to prediction. It is said that using farmers' field trials is better than best practices to identify adaptive management options within complex agricultural systems (Eldon et al. 2016). Therefore, a series of CFFTs and demonstrations of maize hybrids was carried out at diverse environments of mid-hills and Terai regions to know the varietal adaptability, stability, and yield potential before releasing for

general/commercial cultivation. Instead of testing hybrids many years in a few locations it will help to identify better hybrids earlier if we test and demonstrate best bet hybrids at various locations within a short period of time in any country.

MATERIALS AND METHODS

A series of CFFTs were carried out at different eco-zones of Nepal i.e. mid-hills, and Terai and inner Terai regions for three consecutive years from 2016/17 to 2018/19. In mid-hills, the CFFT sets comprising six, seven and six promising hybrids along with multi-national hybrid P3533, Rajkumar and CP808 as commercial checks were evaluated in 2016/17, 2017/18 and 2018/19, respectively at three (Kabre, Salyan, and Dailekh), six (Pakhribas, Kabre, Khumaltar, Lumle, Salyan, and Dailekh) and five (Kabre, Khumaltar, Salyan, Surkhet, and Dailekh) different locations. Similarly, seven and eight, as well as six elite maize hybrids developed by NMRP including CP808 as commercial check were evaluated in farmers' field at four locations of eastern Terai (Tarahara, Belachapi, Parwanipur, and Madi) and two locations of middle and western Terai (Rampur and Nepalgunj) in 2017/18 and five locations of eastern and middle Terai (Maharanijhoda, Tarahara, Belachapi, Parwanipur, and Rampur) in 2018/19, respectively. Hybrid demonstrations having an area of 30 sq m (10 rows of 5 m long) for each entry were carried out in farmers' field at different locations (Maharanijhoda, Tarahara, Sagarnath, Dumarwana, and Parwanipur) of Terai region in 2018/19. In these locations, two pipelines, five released, and one multi-national (P3396) hybrids were demonstrated. The geographic description of experimental/demonstration sites is presented in Table 1.

The trials were planted during summer in the mid-hills and winter in Terai and inner Terai. Each trial was laid out in a randomized complete block design (RCBD) where a farmer was used as a replicate in each site. In mid-hills, the experimental plot size was 6 rows of 3-m long and in Terai was 6 rows of 5-m long with the spacing of 60 cm and 25 cm. All the agronomic practices were performed as per NMRP's recommendation. The fertilizer dose was 180:60:40 NPK kg ha⁻¹ in all the cases. The yield data were recorded from the middle four rows for each trial. The grain yield was adjusted in a 15% moisture level assuming 80% shelling recovery. All the yield and yield attributing parameters were analyzed using Genestat and MS-Excel.

Table 1. Geographic description of experimental/demonstration locations

Location	Elevation, masl	Annual rainfall (mm)	Longitude	Latitude
Agriculture Research Station (ARS), Pakhribas, Dhankuta	1315-2025	1500-1600	87°17'61"E	27°02'96"N
Regional Agricultural Research Station (RARS), Tarahara, Sunsari	136	1935	87°16'38.43"E	26°42'16.85"N
Ekikrit Krishak Samuha, Maharanijhoda, Jhapa	103		87°42'15"E	26°34'41"N
Agriculture Research Station (ARS), Belachapi, Dhanusha	107.1	1280	85°57'E	26°53'N
Hill Crops Research Program (HCRP), Kabre, Dolakh	1600-1740	2466.2	86°80'E	27°38'N
Sagarnath, Sarlahi	130		85°40'14"E	26°58'43"N
Dumarwana, Bara	126		85°02'58"E	27°07'41"N
Regional Agricultural Research Station (RARS), Parwanipur, Bara	115	1550	84°53'E	27°2'N
Agricultural Botany Division (ABD), Khumaltar, Lalitpur	1368	1238	85°20'E	27°40'N
Madi, Chitwan	253		84°21'47"E	27°25'42"N
National Maize Research Program (NMRP), Rampur, Chitwan	228	2215	84°20'20.9"E	27°39'0.3"N
Regional Agricultural Research Station (RARS), Lumle, Kaski	1740	3172.85	83°58'27.72"E	28°13'6.8"N
Ginger Research Program (GRP), Kapurkot, Salyan	1480	1897.3	82°24'E	28°14'N
Regional Agricultural Research Station (RARS), Khajura, Banke	181	1000-1500	81°35'23"E	28°06'48"N
Agriculture Research Station (ARS), Dasharathpur, Surkhet	580	1100.3	81°47'E	28°30'N
Horticulture Research Station (HRS), Kimugaon, Dailekh	1230-1290	1500	81°43'19.4"E	28°50'49.8"N
Regional Agricultural Research Station (RARS), Bhagetada, Doti	510	<1000	80°55'E	29°15'N

RESULTS AND DISCUSSION

During summer in 2016/17 and 2018/19, the observation regarding days to anthesis and silking was statistically non-significant among the tested hybrids across the mid-hills locations (Tables 2 and 4). However, RML-95/RML-96 was significantly earlier at Kabre and Dailekh in 2016/17 (data not shown). Similarly, in 2017/18 significantly earlier anthesis of 70 days and silking of 73 days were observed with RML-37/RL-105 followed by Rampur hybrid-10 (Table 3) over the locations. All the hybrids required comparatively more days for anthesis of 94 days and silking of 99 days at Lumle where significantly fewer days for male flowering were observed with RL-150/RL-111 (3 days earlier than mean). Likewise, pooled data from different locations of the Terai region showed non-significant results for days to anthesis and silking of the tested hybrids in 2017/18. CP808 and RML-

95/RML-96 as well as RML-86/RML-96 took fewer days to complete 50% anthesis i.e 110 and 112 days, respectively (Table 5). Our finding is supported by the results of Tripathi et al. (2011) who mentioned the protandry nature of maize. Besides, there were statistically lower growing degree days (GDDs) required to complete 50% anthesis to both Rampur Hybrid-8 and P3396 under demonstration and farmers' field trials (111 and 120 days) conducted at various location of Terai and Inner Terai in 2018/19 (Table 8). Maize grain yield is strongly associated with flowering parameters. Bolanos and Edmeades (1996) reported that the value of $r_{GY,AD}$ (between grain yield and days to anthesis) averaged 0.47 ± 0.18 suggesting earlier-flowering genotypes were connected for higher grain yield.

Plant and ear height

The combined mean of plant and ear height of

Table 2. Performance of maize hybrids on phenology, height, and grain yield under farmers' field trials in mid-hills, summer 2016/17

Genotype	Days to 50%		Height, cm		Grain yield, kg ha ⁻¹			
	Anthesis	Silking	Plant	Ear	Kabre	Salyan	Dailekh	Mean
RML-95/RML-96	64	67	222	135	4300	8600	8300	7070
RML-86/RML-96	68	71	227	131	4900	7900	9400	7400
Rampur Hybrid-4	65	68	221	123	7600	7800	7200	7530
Rampur Hybrid-6	67	69	229	128	9600	9800	9200	9530
P3533	64	66	285	149	11900	12900	8300	11030
Rampur Hybrid-2	64	67	226	136	6000	7400	8200	7200
Minimum	64	66	221	123	4300	7400	7200	7070
Maximum	68	71	285	149	11900	12900	9400	11030
Mean	65	68	235	134	7400	9100	8400	8290
F-test	ns	ns	**	**	**	ns	ns	ns
LSD _{0.05}	-	-	10.7	11.6	2600	-	-	-
CV, %	4.1	4	2.5	4.8	13.6	28.7	11.6	20.1

Table 3. Performance of maize hybrids on phenology, height, and grain yield under farmers' field trials in mid-hills, summer 2017/18

Genotype	Days to 50%		Height, cm		Grain yield, kg ha ⁻¹						
	Anthesis	Silking	Plant	Ear	Pakhribas	Kabre	Khumaltar	Lumle	Salyan	Dailekh	Mean
Rajkumar	74	77	225	114	1285	9446	7914	6884	5478	7065	6345
Rampur Hybrid-10	72	74	244	128	5470	6588	8183	6298	5060	7198	6466
Rampur Hybrid-6	76	79	225	124	4589	8720	7418	5579	7290	6758	6726
Rampur Hybrid-8	74	77	231	115	4528	6973	7362	6390	5847	6935	6339
RL-150/RL-111	73	77	253	142	4685	7571	10690	4876	8293	6945	7177
RML-37/RL-105	70	73	224	121	4248	5090	6935	4548	4973	6925	5453
RML-95/RML-96	74	78	219	114	4245	5698	6576	3757	8858	7980	6186
Minimum	70	73	219	114	1285	5090	6576	3757	4973	6758	5453
Maximum	76	79	253	142	5470	9446	10690	6884	8858	7980	7177
Mean	73	76	232	122	3978	7180	8038	5441	6626	7172	6369
F-test	**	**	*	**		*		ns		ns	ns
LSD _{0.05}	2	2	19	10		2704		-		-	-
CV, %	2	2	7	7		21		23.1		10.2	20

tested hybrids over different locations of the mid-hill region in 2016/17 (Kabre, Salyan, and Dailekh) and 2017/18 (Pakhribas, Kabre, Kumaltar, Lumle, Salyan, and Dailekh) differed significantly. Hybrid P3533 attained maximum plant height of 285 cm and ear height of 149 cm across the locations in 2016/17, whereas out of seven hybrids tested in mid-hill region, Nepali hybrid RL-150/RL-111 was observed with a significantly taller plant height of 253 cm in 2017/18 (Table 2 and 3). Similarly, significantly taller plant height of 206 cm was recorded in RML-76/RML-105 followed by P3396 of 207cm, and CAH1715 of 213 cm when averaged over locations in farmers' field of Terai and inner Terai in 2017/18 and 2018/19 (Table 6, 7 and 8). Neupane et al. (2019) also reported P3396 as a hybrid with taller plant height. Growing plants in competitive environments influence their height due to light interception, carbon and nutrient capture, and weed competition (Lin et al. 1995). According to Hegyi and his colleagues (2002) increased plant and ear height was recorded when plant population was increase from 45000 ha⁻¹ to 85000 ha⁻¹.

Similarly, it was reported that plant height is mainly determined by the variety and sowing date

however, habitat has a considerable effect on their height. A significant difference was reported in plant height of the same variety grown in different areas (Wu 1988).

Grain yield

The combined mean grain yield of tested hybrids in farmers' field over the various mid-hill locations was insignificant in 2016/17. However, a significantly and comparatively higher yield of 11900 kg ha⁻¹ was produced by P3533 at Kabre (Table 2). This might be due to good plant vigor with a plant height of 285 cm of this hybrid. Increased plant height provides more green areas for increased photosynthetic activities and assimilates needed for grain filling (Haseeb-ur-Rehman et al. 2010) resulting in a highly significant positive genotypic correlation of plant height with grain yield (Halidu et al. 2015). Similarly, the overall yield of the hybrid RL-150/RL-111 having the highest plant height of 253 cm yielded 7177 kg ha⁻¹ across the mid-hill region during summer 2017/18. But in Kabre, multi-national company hybrid Rajkumar produced a significantly higher yield of 9446 kg ha⁻¹ followed by Rampur Hybrid-10 of 8720 kg ha⁻¹ (Table 3).

Table 4. Performance of maize hybrids on phenology, height, and grain yield under farmers' field trials in mid-hills, summer 2018/19

Genotype	Days to 50% anthesis	Plant height, cm	Grain yield, kg ha ⁻¹					Mean
			Kabre	Khumaltar	Salyan	Surkhet	Dailekh	
CP808	68	244	12827	6548	5622	5628	9985	8122
Rampur Hybrid-6	72	212	7922	4990	3778	5700	6510	5780
RML-4/RL-105	69	248	10836	-	3928	6044	9560	7592
RML-76/RL-105	69	244	9751	-	3592	3833	7740	6229
RML-86/RML-96	69	236	10718	6849	3120	4549	9222	6892
RML-95/RML-96	68	238	10782	6212	3031	4712	8109	6569
Minimum	68	212	7922	4990	3031	3833	6510	5780
Maximum	72	248	12827	6849	5622	6044	9985	8122
Mean	69	235	10448	6073	3966	5043	8453	6886
F-test	ns	ns				ns	ns	**
LSD _{0.05}	-	-				-	-	1335
CV, %	4.0	8.5				28.30	12.10	12.7

Note: At Khumaltar Rajkumar was used as multi-national company hybrid check instead of CP-808

Table 5. Performance of maize hybrids on phenology, height, and grain yield under farmers' field trials in Terai and inner Terai environment, winter 2017/18

Genotype	Days to 50% anthesis	Plant height, cm	Grain yield, kg ha ⁻¹				
			Tarahara	Belachapi	Parwanipur	Madi	Mean
RML-95/RML-96	112	182	6440	7685	6908	5605	6660
RML-86/RML-96	112	191	5998	9078	8708	6461	7561
Rampur Hybrid-4/RML-17	114	168	3716	7077	5119	5859	5443
Rampur Hybrid-6/RML-17	114	156	5229	6535	5423	5300	5622
Rampur Hybrid-8	113	179	1021	8291	7458	6819	5897
Rampur Hybrid-10	113	178	2005	5169	5609	6474	4814
CP808	110	196	3691	10074	6742	8235	7186
Minimum	110	156	1021	5169	5119	5300	4814
Maximum	114	196	6440	10074	8708	8235	7561
Mean	113	179	3951	7683	6644	6476	6173
Genotype	ns	*				*	ns
Environment	**	**					**
LSD _{0.05}	-	20				1577	1989
CV, %	2	7				14	22

Similarly, in the farmers' field trials conducted at various sites of mid-hills, the multi-national company hybrid CP808 produced significantly higher mean grain yield of 8122 kg ha⁻¹ which was at par with RML-4/RL-105 of 7592 kg ha⁻¹ and RML-86/RML-96 of 6892 kg ha⁻¹ across the locations in summer 2018/19 (Table 4). The data in table 5 represent the grain yield of different maize hybrids evaluated in CFFT's at various locations of Terai during winter 2017/18. The analyzed data regarding the locations showed a highly significant difference in terms of grain yield. The environment of Belachapi was significantly best suited for cultivating hybrid maize compared with other sites. Conversely, the differences in pooled mean grain yield from the different locations were found non-significant among tested hybrids. CP808 recorded the significantly higher grain yield of 8235 kg ha⁻¹ which was at par with Rampur Hybrid-8 of 6819 kg ha⁻¹ at Madi, Chitwan. Those two hybrids also produced comparatively higher grain yield at Rampur and Nepalgunj under farmers' field in 2017/18. The mean averaged over locations of

tested hybrids was 9887 kg ha⁻¹ at Rampur and 6770 kg ha⁻¹ at Nepalgunj (Table 6).

The combined grain yield recorded at various locations of Terai and inner Terai was found highly significant among the tested hybrids under CFFT's and the demonstration in 2018/19. Out of six tested hybrids in CFFT's, a statistically higher grain yield of 7675 kg ha⁻¹ was obtained from CAH1715 which was at par with P3396 of 7652 kg ha⁻¹, RML-95/RML-96 of 7460 kg ha⁻¹ and Rampur Hybrid-8 of 6762 kg ha⁻¹ (Table 7). While in the demonstration, RML-86/RML-96 produced significantly more yield of 7319 kg ha⁻¹ followed by P3396 of 7113 kg ha⁻¹ and Rampur Hybrid-4 of 6930 kg ha⁻¹ (Table 8).

Stability analysis

Stability analysis revealed that the highest yielding hybrids were not necessarily the most stable. The pipeline hybrid RML-95/RML-96 was the most stable with the regression value of 1.02 followed by RML-86/RML-96 over the years across the locations of the mid-hills in Nepal

Table 6. Performance of maize hybrids on phenology, height, and grain yield under farmers' field trials at outreach sites of NMRP, Rampur and RARS Nepalgunj, winter 2017/18

Genotype	Days to 50%		Height, cm		Grain yield, kg ha ⁻¹		Mean
	Anthesis	Silking	Plant	Ear	Rampur	Nepalgunj	
RML-95/RML-96	101	104	171	85	8629	5790	7210
RML-86/RML-96	101	103	167	78	8188	6193	7190
Rampur Hybrid-4/RML-17	99	102	175	84	9790	6551	8170
Rampur Hybrid-6/RML-17	99	102	181	90	8574	6609	7592
Rampur Hybrid-8	100	102	166	70	12839	7203	10021
RML-76/RML-105	100	103	206	108	9856	5637	7746
CP808	100	102	200	90	14448	8645	11547
Rampur Hybrid-4/RML-62	99	102	184	87	6050	6791	6420
Minimum	99	102	166	70	6050	5637	6420
Maximum	101	104	206	108	14448	8645	11547
Mean	100	102	181	86	9887	6770	8237
Genotype	ns	ns	ns	ns			ns
Environment	**	**	*	**			*
LSD _{0.05}	2	2	38	23			-
CV, %	1	0.9	8.7	11.2			18.5

Table 7. Performance of maize hybrids on phenology, height, and grain yield under farmers' field trials at various locations in Terai and inner Terai environment, winter 2018/19

Genotype	Days to 50%		Height, cm		Grain yield, kg ha ⁻¹					
	Anthesis	Silking	Plant	Ear	Maharajghoda	Tarahara	Belachapi	Parwanipur	Rampur	Mean
RML-95/RML-96	118	119	187	91	7048	8499	6269	7191	8293	7460
RML-86/RML-96	124	126	172	84	5830	6942	4548	7811	4523	5931
Rampur Hybrid-6/RML-17	122	123	156	66	4690	7361	3003	5472	4019	4909
P3396	120	121	183	69	7675	8531	4102	8758	9194	7652
Rampur Hybrid-8	120	121	185	75	6779	7685	5890	7029	6425	6762
CAH1715	122	123	213	94	8346	8757	4800	7523	8949	7675
Minimum	118	119	156	66	4690	6942	3003	5472	4019	4909
Maximum	124	126	213	94	8346	8757	6269	8758	9194	7675
Mean	121	122	183	80	6676	7934	4736	7252	6827	6622
F-test	ns	ns	**	**						**
LSD _{0.05}	-	-	14.2	14.8						1276
CV, %	3.1	3.1	5.8	13.8						14.4

(Figure 1). This indicates a huge expanding scope of these hybrids in these regions. On the other hand, commercial hybrid CP808 although yielded more than 8639 kg ha⁻¹ was least stable concerning the different environments of Terai and Inner Terai. It means CP808 proved itself a location-specific hybrid with b value of 1.86. Another commercial multi-national hybrid P3396 possessed good stability and adaptability with a mean grain yield of 7358 kg ha⁻¹ followed by Rampur Hybrid-10 over the years across the diverse environments of the Terai region (Figure 2). The grain yield performance of the genotypes differed from one location to another was reported by Mafouasson et

al. in 2018. Akcura and his colleagues (2011) reported that the diverse environmental conditions aggravate the effect of genotype × environment interaction that often hampers on the selection of stable and high yielding genotypes.

CONCLUSIONS

Multi-national hybrids CP808 and heat stress resilient hybrid CAH1715 produced a significantly higher yield of 8122 and 7566 kg ha⁻¹ in mid-hills and Terai, respectively under CFFTs. Pipeline hybrid RML-86/RML-96 exhibited remarkably more grain yield in the demonstration in Terai during 2018/19. From the two to three years grain

Table 8. Performance of maize hybrids on phenology, height, and grain yield under demonstration in farmers' field at various locations in Terai and inner Terai environment, winter 2018/19

Genotype	Days to 50%		Height, cm		Grain yield, kg ha ⁻¹						
	Anthesis	Silking	Plant	Ear	Maharajghoda	Tarahara	Sagar nath-1	Sagar nath-2	Dumar wana	Par wanipur	Mean
Rampur Hybrid-2	120	122	146	77	7879	1476	-	-	6381	1430	4292
Rampur Hybrid-4	113	117	170	82	8511	8339	7229	5527	8448	3523	6930
Rampur Hybrid-6	115	118	184	97	7205	7272	6213	6155	7735	4900	6580
Rampur Hybrid-8	111	115	206	91	5895	6156	7229	4614	7183	5913	6165
Rampur Hybrid-10	114	117	201	87	8597	4900	5989	5306	5339	3166	5549
RML-95/RML-96	114	118	191	93	7946	7912	6387	6431	6274	4364	6552
RML-86/RML-96	117	121	188	95	8690	8328	8100	6241	7953	4604	7319
P3396	111	112	207	85	7701	7418	6747	7228	8149	5433	7113
Minimum	111	112	146	77	5895	1476	5989	4614	5339	1430	4292
Maximum	120	122	207	97	8690	8339	8100	7228	8448	5913	7319
Mean	114	117	187	89	7701	6162	6887	5927	7125	4068	6211
F-test	**	**	**	**							**
LSD0.05	3	2	11	8							1307
CV. %	1.7	1.4	5.2	7.8							17.6

Figure 1. Grain yield stability of pipeline maize hybrids over the year across the different location of Mid-hill region

Figure 2. Grain yield stability of maize hybrids over the year across the different locations of Terai and inner Terai

yield data, it was concluded that NMRP developed hybrids namely RML-86/RML-96, RML-95/RML-96, CAH1715, and Rampur Hybrid-6 have the substantial potentiality to contribute to increasing the average maize yield in Nepal and helps to fulfill the swelling demand for maize. Mostly stable hybrids, in terms of grain yield, in the mid-hills were RML-86/RML-96 and RML-95/RML-96, and in the Terai and inner Terai were P3396 and Rampur Hybrid-10.

ACKNOWLEDGMENTS

Financial support from NARC for this project is duly acknowledged. The authors express their sincere thanks to the research team of NMRP Rampur, ARS Pakhribas, RARS Tarahara, ARS Belachapi, HCRP Kabre, RARS Parwanipur, ABD Khumaltar, RARS Lumle, GRP Salyan, RARS Khajura, ARS Surkhet, HRS Dailekh, and RARS

Doti. Farmers and cooperatives involved in the experimentations and demonstrations are highly acknowledged. All the personages who provided valuable feedback and suggestions from field to paper are highly appreciated.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

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