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EVALUATION OF MAIZE GENOTYPES FOR HIGH TEMPERATURE TOLERANCE IN TERAI REGION OF NEPAL

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Abstract: High temperature reduces the pollen viability and silk receptivity of maize resulting in poor seed set and reduced yield. To identify and select the high temperature tolerant maize genotypes for terai region of Nepal, the field experiments were conducted at NMRP Rampur, RARS Parwanipur and RARS Nepalgunj during summer season of 2010. The fourty four genotypes were evaluated in randomized complete block design with three replications. Observations on days to tasseling and silking, plant height, ear height, ear length, ear diameter, stem borer, wilt and grain yield were taken. Analysis of ANOVA showed that the parameters on days to tasseling and silking, plant height and ear height, ear length, ear diameter was found significant for tested locations. Combined statistical analysis showed that all the genotypes were highly significant for days to 50% tasseling and silking, plant height, ear height, ear length, plant aspect, ear aspect and grain yield but non significant for ear diameter and stem borer. Data on wilt % was found also significant. Result on Anthesis-silking interval (ASI) was significant for genotypes and location but non significant for genotypes x location. The result indicated that Manakamana-4 produced the highest grain yield (5298.61 kg/ha), followed by Upahar (5227.92 kg/ha) and TLBRS SO7F16 (5144.32 kg/ha) respectively.

Key words: high temperature and grain yield.

INTRODUCTION

Among the various abiotic stresses, high temperature is one of major environmental constraints that limit crop productivity worldwide. A rise in temperature (+30 ^{0}C), pollen shedding starts much ahead of silks emergence while silking is delayed, so that silking period does not correspond to anthesis/tasseling, increasing anthesis-silking interval (ASI), resulting in poor synchronization of flowering (asynchrony). Further rise in temperature reduces the pollen viability and silk receptivity resulting in poor seed set and reduced yield (Samuel *et al*., 1986). The major effect of high temperature is embryo abortion, which is related to the inhibition of photosynthesis and the subsequent reduction in assimilates available to developing kernels. An increase in the anthesis-silking interval (ASI) can occur under high temperature condition. Result is barrenness due to failure of pollination.

Maize as C4 plant is efficient user of moisture for dry matter production and requires 500-800 mm of water during life cycle of 80-110 days (Critchley & Klaus, 1991). At the time of tasseling maize requires 135 mm per month and this may increase up to 195 mm per month during hot windy conditions. Yield reduction of 50% or more are recorded when drought occurs during sensitive flowering stages (Claassen and Shaw, 1970). Edmeades *et al* (1990) reported that drought on average reduces annual grain yield by 10 to 50% on 80% of the area sown to maize in the lowland tropics. Significant yield losses in maize from drought are expected to increase with global climate change as temperature rises and rainfall distribution changes in key traditional production areas.

Majority of maize fields in Nepal are under rainfed condition. Nepal faces serious problems of shortage of water due to low and irregular rain fall which resulted in heavy crop losses. In the view of various climatic change models scientists suggested that in many regions

of world, crop losses due to increasing aridity will further increase in future (Athar & Ashraf, 2005). Thus, the threat and effects of shortage of water on crop productivity are becoming more alarming. Maize has high production potential among the primary maize growing countries in the world, Italy (9322 kg/ha) was first for higher productivity (Narang and Gill, 2004) but in Nepal its productivity is only 2119 kg/ha with 1855184 mt production (MOAC, 2009/10). Average yields are low and unstable because most maize is grown under rainfed condition with fluctuating rainfall. The present yield of maize in Nepal is quite lower than that of other Asian countries. Therefore, different effective measures should be adopted to increase the crop yield. Screening and selection of different maize genotypes with considerable water stress tolerance has been considered an economic and efficient means of utilizing drought-prone areas when combined with appropriate management practices to reduce water loss and increase grain yield (Rehman *et al*., 2005). Thus, improved water stress tolerance is one of major objectives of plant breeding programs for crops grown in dry areas.

Keeping in view all above information, present study was conducted during dry period of summer season of 2010 at Rampur, Parwanipur and Nepalgunj under rainfed condition to develop the high temperature tolerant maize genotypes. In addition, genotypic variation was also assessed for growth and yield attributes that could be used as selection criteria for developing heat tolerant genotypes.

MATERIALS AND METHOD

The experiment was conducted using 44 maize genotypes at NMRP Rampur, RARS Parwanipur and RARS Nepalgunj during summer season of 2010. The experimental designs were randomized complete block designs with three replications. Planting was done in May 14th 2010. Row to row 75 cm and plant to plant 25 cm was maintained. Plot size was two rows with 3 meter length. Organic matter @ 10 ton FYM /ha was applied during the field preparation. Fertilizer dose at 120:60:40 NPK/ha was applied in the experimental field. Nitrogen half dose, P_2O_5 and K_2O in full doses were used in the planting time. Remaining half doses of nitrogen again divided into two proportions whose first half dose applied on 3th June 2010 (21 days after sowing) at time of weeding and second dose was applied as side dressing on 1st July, 2010 (45 day after sowing). All intercultural operations were done as usual. The statistical analysis of data was carried out using MSTAT program.

RESULTS AND DISCUSSIONS

The combined statistical analysis of the fourty four genotypes evaluated at Parwanipur, Rampur and Nepalgunj during summer, 2010 showed that the parameters on 50 % tasseling and silking, plant height, ear height, ear length, plant aspect, ear aspect and grain yield were found highly significant but non significant for ear diameter.The genotype Manakamana-4 produced the highest grain yield (5298.61 kg/ha), followed by Upahar (5227.92 kg/ha) and TLBRS SO7F16 (5144.32 kg/ha) significant for interaction. The results of the experiment indicated that maize genotype RML-4/NML-2 produced the highest tasseling days (64.00) followed by genotypes SO1SIWQ-3 (63.67) and RampurSO3 (61.83) respectively. The mean data of days to 50% tasseling was found 54.88 days. The earliness in tasseling days was occurred because of water stress during crop growing period. The highest days to 50% silking was observed on PUTU-13 (67.0) followed by RML-4/NML-2 (66.67) and S99TLYQ-B (65.83). The anthesis-silking interval was longest in BGBYPOP (6.167 days) followed by Deuti (5.167 days) and BLSBS07F10 (4.500 days) respectively. The average values of plant height (179.655 cm), ear height (86.34 cm), ear length (13.69 cm), ear diameter (3.93), plant aspect (2.15), ear aspect (2.57), unfilled ear (16.4%), non grain ear (4.24%) were achieved. The average values of biotic infestation i.e. wilt infestation was found only 7.11% and stem borer attack is 1.94%. The less attack of pests was due to moisture stress resulting in low humidity during crop growing period.

The findings of the Parwanipur trial showed that grain yield ranges from 1426.25 kg/ha (RL-84) to 4400.12 kg/ha (NML-1/NML-2). The genotypes varies from 2507.29 kg/ha (PUTU-13) to 7375.56 kg/ha (Upahar) for grain yield at Nepalgunj. Similarly, in Rampur, the grain yield varies from 1164.25 kg/ha (POP-446) to 6231.09 kg/ha (Manakamana-4). The results showed that grain yield was significant at Rampur and Parwanipur but highly significant at Nepalgunj. Data on days to 50% tasseling, days to 50% silking, plant height and ear height were found highly significant at each location where as plant aspect and ear aspect were highly

significant at Rampur and Nepalgunj but non significant at Parwanipur. Similarly, ear diameter was found non significant at each location.

Table 1.Combined analysis for agronomic performance of maize genotypes conducted at three different locations (Rampur, Nepalgunj and Parwanipur) during summer season of 2010

S. N.	Genotypes	Days to 50 %		Pl. ht. (cm)	Ear ht. (cm)	Ear Len. (cm)	Ear dia. (cm)	Grain Yield (kg/ha)
		tasseling	silking					
1	RML-7	58.5	63.67	187.67	88.67	10.97	3.573	2719.32
2	RL-84	55.67	59.17	165.77	79.33	12.78	3.428	3674.69
3	RL-30-1	56.67	61.17	164.50	88.67	14.10	3.507	2890.49
4	PUTU-13	60.83	67.00	139.00	66.00	11.02	3.355	2670.86
5	Pool-17	45.17	47.00	160.67	70.17	10.53	2.950	3220.52
6	Arun-1EV	47.17	50.00	166.67	78.50	13.07	4.012	2942.71
7	Arun-4	57.17	61.50	171.17	75.00	14.58	3.978	3564.43
8	POOl -16	50.50	54.83	164.83	78.00	12.67	3.697	2927.42
9	Narayani	50.00	51.83	170.00	85.50	13.99	3.983	4110.19
10	Upahar	61.00	62.17	189.67	90.17	14.33	4.118	5227.92
11	Across-9331	53.17	55.67	173.00	90.33	13.57	4.038	3887.77
12	S 97 TLYHGA YB (3	52.00	54.33	173.33	77.00	12.49	3.695	3069.05
13	Rampur Composite	54.83	57.00	185.83	88.00	12.92	3.988	4086.00
14	Mana-4	55.83	56.83	181.83	86.83	13.82	3.673	5298.61
15	Arun-2	48.83	52.67	172.50	84.50	12.59	3.900	3409.29
16	OEHPW	57.67	60.83	203.17	97.17	15.41	4.057	4451.39
17	P501/RCO/P 502 SRCO	59.50	63.67	171.50	68.50	12.85	3.830	3419.31
18	BGBY POP	60.33	64.50	183.50	93.00	15.50	4.143	5109.74
19	S99TYQ-HGB	55.83	57.67	174.67	84.00	13.10	3.928	4193.99
20	Posilo Makai-1	58.50	63.67	187.00	89.67	14.99	4.252	4636.33
21	SO 1 SIWQ3	63.67	65.50	163.67	67.33	12.58	3.802	3498.03
22	S 99 TLYQ-B	61.33	65.83	177.33	77.83	12.94	3.833	3418.64
23	Rampur SO 3 FO2	56.17	59.33	190.17	96.33	15.01	4.005	4345.11
24	Rampur SO 3 FO4	55.67	59.33	168.83	77.50	14.23	3.660	3981.91
25	Rampur SO3 FO6	56.83	60.00	191.50	91.50	14.26	4.173	4068.70
26	Rampur SO3 FQ-02	61.83	65.33	182.50	82.33	13.94	3.812	3909.96
27	BLSB SO7 F 10	53.50	55.67	174.17	86.67	14.42	3.833	4103.83
28	BLSB SO 7 F12	57.33	59.50	183.17	89.33	13.75	3.788	4465.73
29	TLBRS SO 7 F 14	54.50	57.50	190.33	86.50	14.25	4.073	4726.70
30	TLBRS SO 7 F16	56.33	59.67	187.67	102.00	14.43	4.185	5144.32
31	R POP-1	54.67	56.83	190.83	93.17	13.39	4.222	4411.47
32	R POP-2	50.00	52.50	196.17	100.50	13.25	3.993	4453.46
33	R POP-3	53.17	55.67	177.83	93.33	14.48	4.118	4194.32
34	R POP-4	51.00	52.83	190.67	98.50	14.00	4.023	4798.69
35	NML-1/NML-2	55.83	57.17	187.17	97.17	15.07	4.003	4780.19
36	RML-4/NML-2	64.00	66.67	165.67	78.00	14.30	4.013	3554.81
37	RML-8/Rampur Composite	48.83	51.33	183.67	85.67	14.43	5.965	4958.32
38	Manakamana-3	57.83	59.83	190.50	98.00	14.75	3.922	4205.61
39	Rampur2	50.50	53.00	171.00	76.00	14.22	3.912	3374.98
40	Deuti	56.83	60.17	192.00	98.17	15.56	3.907	4184.94
41	Pop-446	50.17	52.67	153.57	62.33	11.78	3.712	1882.67
42	Khumal Yellow	50.67	54.50	176.50	86.33	12.75	4.052	4366.01
43	Gulmi	53.67	56.33	233.50	122.00	14.96	4.023	3734.14
44	Resunga Composite	53.67	57.00	200.17	93.67	14.33	3.898	4631.11
	Grand mean	54.88	57.80	179.655	86.34	13.69	3.93	3970.53
	CV(%)	5.40	5.70	9.56	14.05	13.32	20.7	28.70
	SE	1.201	1.337	7.375	5.124	0.759	0.470	464.405
	LSD(0.05)	3.361	3.740	20.6313	14.33	2.12364	0.927	1299.1
	F-test							
	Genotypes (G)	**	**	**	**	**	NS	**
	Location (L)	**	**	NS	*	*	NS	**
	Interaction (G × L)	**	**	NA	NA	*	NA	NS

*ASI: anthesis-silking interval, pl:plant, ht: height, Len.: length, dia: diameter, Asp.:aspect and Gr.:grain, NS=Non significant, NA:Not available, * significant at 1% level and **significant at 5% level.*

Table 2. Analysis for agronomic performance of maize genotypes conducted at Parwanipur during summer season of 2010.

S. N.	Genotypes	Days to 50 % tasselling	Days to 50 % silking	Plant height (cm)	Ear height (cm)	Ear length (cm)	Ear diameter (cm)	Grain yield (kg/ha)
1	RML-7	58.00	63.00	178.50	91.50	9.30	3.47	1838.59
2	RL-84	63.50	70.00	153.80	79.00	9.75	2.81	1426.25
3	RL-30-1	62.00	63.50	160.50	89.50	12.70	3.43	1888.52
4	PUTU-13	57.00	65.00	139.00	70.50	9.50	3.00	3834.22
5	Pool-17	46.00	47.00	149.50	64.50	11.60	3.22	2598.80
6	Arun-1EV	49.00	51.50	170.00	78.50	12.12	3.67	2739.08
7	Arun-4	48.00	50.00	174.50	84.00	12.94	3.50	2971.76
8	POOl -16	51.00	52.50	150.00	70.00	11.32	3.17	2046.06
9	Narayani	54.50	59.50	174.50	92.00	11.17	3.58	2846.96
10	Upahar	56.00	60.00	178.50	85.00	11.70	3.44	3509.06
11	Across-9331	52.00	54.50	184.50	100.50	12.50	3.97	3990.04
12	S 97 TLYHGA YB (3)	54.00	57.00	151.50	69.50	9.68	3.23	2014.17
13	Rampur Composite	53.50	55.50	192.00	101.00	10.57	3.57	3262.12
14	Manakamana-4	57.50	60.50	177.00	102.00	11.66	3.13	3287.41
15	Arun-2	51.00	55.00	156.50	81.00	12.38	3.72	3666.09
16	OEHPW	56.00	59.00	213.00	107.50	15.42	3.68	3958.10
17	P 501/RCO/P 502 SRCO	58.50	63.50	157.00	60.00	10.36	3.12	1481.99
18	BGBY POP	60.00	64.50	177.50	97.50	15.61	3.84	4264.94
19	S99 TYQ-HGB	56.00	57.50	155.50	80.00	10.40	3.36	2311.49
20	Posilo Makai-1	57.50	63.00	173.50	90.50	12.98	3.95	3264.66
21	SO1 SIWQ3	65.50	67.50	148.00	59.00	10.13	3.56	1880.88
22	S99 TLYQ-B	64.00	68.50	176.50	78.50	10.41	3.10	1942.79
23	Rampur SO 3 FO2	56.50	59.50	187.50	87.00	14.83	3.33	3213.22
24	Rampur SO 3 FO4	57.50	60.50	153.50	75.00	12.28	2.87	2715.00
25	Rampur SO 3 FO6	57.50	60.50	192.00	95.50	12.48	3.58	3078.60
26	Rampur SO 3 FQ-02	67.50	71.00	163.50	74.50	11.32	3.13	2004.01
27	BLSB SO7 F 10	53.50	55.50	185.00	96.00	14.07	3.61	3907.90
28	BLSB SO 7 F12	57.50	59.00	181.00	90.00	13.35	3.27	3459.14
29	TLBRS SO 7 F 14	55.00	58.00	184.50	90.50	12.14	3.63	3629.00
30	TLBRS SO 7 F 16	56.50	60.00	204.50	114.00	15.99	4.22	4036.49
31	R POP-1	53.50	55.50	188.00	102.50	11.47	3.76	2338.97
32	R POP-2	52.50	54.00	198.00	109.50	13.25	4.09	4317.62
33	R POP-3	53.00	55.50	179.50	93.50	11.15	3.99	3845.49

34	R POP-4	51.50	53.00	200.50	112.50	12.64	3.20	3741.46
35	NML-1/NML-2	56.50	58.00	192.00	98.00	13.42	3.74	4400.12
36	RML-4/NML-2	68.00	71.00	153.00	75.00	13.00	3.90	2308.43
37	RML-8/Rampur Composite	49.00	51.50	188.00	91.00	13.10	3.90	4336.14
38	Manakamana-3	58.00	60.00	195.00	110.00	13.95	3.49	4132.54
39	Rampur-2	50.50	53.50	165.00	75.50	10.87	3.27	2876.27
40	Deuti	56.00	59.00	204.00	116.00	13.88	3.80	2959.83
41	Pop-446	50.00	52.50	139.20	62.00	9.33	2.99	1643.92
42	Khumal Yellow	50.50	55.00	159.00	82.50	11.74	3.98	3986.49
43	Gulmi	53.50	55.50	243.00	136.50	13.09	3.67	2880.49
44	Resunga Composite	52.00	55.50	192.50	94.50	10.78	3.62	3158.70
	Grand mean	55.6023	58.6705	175.898	88.9318	12.0982	3.51261	3045.31
	CV (%)	6.75	7.40	11.50	15.95	14.99	510.11	28.84
	LSD (0.05)	7.565	8.751	40.783	28.604	3.658	79.548	1771.18
	F-test	**	**	**	**	*	NS	*

Table 3. Analysis for agronomic performance of maize genotypes conducted at Nepalgunj during summer season of 2010

S. N.	Genotypes	Days to 50% tasselling	Days to 50% silking	Plant height (cm)	Ear height (cm)	Ear length (cm)	Ear diameter (cm)	Grain yield (kg/ha)
1	RML-7	60.00	66.00	191.00	78.00	11.00	3.43	2781.15
2	RL-84	56.00	60.00	170.50	72.50	13.30	3.50	3522.81
3	RL-30-1	61.50	63.50	154.50	72.50	16.40	3.53	4120.31
4	PUTU-13	64.00	71.50	125.50	53.50	9.65	3.57	2507.29
5	Pool-17	45.50	47.00	157.00	63.00	6.90	1.75	3882.02
6	Arun-1EV	49.00	51.50	168.50	72.00	13.70	4.07	4262.74
7	Arun-4	48.50	50.50	160.50	67.00	16.90	4.24	4452.65
8	Pool -16	55.50	57.50	174.00	82.00	14.50	4.08	4407.45
9	Narayani	54.00	58.00	181.00	73.00	15.80	4.36	5717.82
10	Upahar	56.00	60.00	189.50	85.00	17.20	4.33	7375.56
11	Across-9331	55.00	58.00	170.00	77.50	15.40	4.08	5163.42
12	S 97 TLYHGA YB (3)	54.00	56.50	173.00	65.00	15.40	3.91	4589.63
13	Rampur Composite	53.50	55.50	184.00	79.00	14.30	4.30	5209.44
14	Manakamana-4	61.50	63.00	175.50	72.00	15.80	3.95	6377.34
15	Arun-2	51.50	54.50	180.50	77.50	13.40	4.01	3734.44
16	OEHPW	56.00	59.00	189.00	81.50	16.00	4.42	5920.54
17	P 501/RCO/P 502 SRCO	58.00	63.50	178.00	66.00	15.40	4.14	5362.42
18	BGBY POP	58.00	63.00	189.50	85.50	16.60	4.42	7369.83
19	S99 TYQ-HGB	56.50	58.00	191.50	84.50	14.40	4.26	5641.58
20	Posilo Makai-1	57.50	63.00	188.50	78.00	17.20	4.61	5117.54
21	SO1 SIWQ3	65.50	67.50	170.00	63.00	16.70	4.23	7174.10

22	S99 TLYQ-B	61.00	66.00	170.50	69.00	14.20	4.23	4619.17
23	Rampur SO 3 FO2	56.50	59.50	179.00	84.00	15.60	4.49	6379.39
24	Rampur SO 3 FO4	59.00	63.00	172.50	69.50	16.10	3.98	5574.16
25	Rampur SO 3 FO6	59.00	64.00	190.00	82.00	17.00	4.68	6126.69
26	Rampur SO 3 FQ-02	67.50	71.00	189.50	73.50	16.40	4.23	6305.15
27	BLSB SO7 F 10	53.00	56.00	159.50	76.00	15.30	3.57	4481.59
28	BLSB SO 7 F12	57.50	59.00	172.00	76.50	14.30	4.10	6188.36
29	TLBRS SO 7 F 14	54.50	58.50	192.00	78.50	15.80	4.20	5593.56
30	TLBRS SO 7 F16	56.00	59.50	181.50	84.50	14.50	4.20	6157.86
31	R POP-1	53.50	55.50	179.50	78.50	15.10	4.36	6202.82
32	R POP-2	51.50	54.50	199.50	90.00	11.10	3.63	4370.56
33	R POP-3	52.50	55.50	173.00	89.50	15.70	3.79	5202.17
34	R POP-4	51.50	53.00	184.00	81.50	15.40	4.20	6339.24
35	NML-1/NML-2	57.00	58.00	184.50	95.00	18.00	3.82	6317.72
36	RML-4/NML-2	66.00	70.00	163.50	68.00	16.40	4.01	4802.48
37	RML-8/Rampur Composite	48.50	51.50	183.50	81.00	15.90	4.30	6355.95
38	Manakamana-3	58.00	60.00	184.50	80.50	15.20	4.08	5134.47
39	Rampur-2	50.50	53.50	170.50	72.00	16.20	4.30	3879.53
40	Deuti	56.00	60.00	185.00	87.00	17.60	3.82	5787.98
41	Pop-446	50.00	52.50	149.50	51.00	11.10	3.95	2839.84
42	Khumal Yellow	49.50	54.50	180.50	80.00	13.60	4.04	5438.70
43	Gulmi	54.00	58.00	221.00	97.50	16.50	4.20	5309.07
44	Resunga Composite	52.00	55.00	213.50	89.50	16.60	3.85	5734.38
	Grand Mean	55.71	58.97	178.18	76.87	14.99	12.93	5223.4
	CV (%)	5.7	5.8	6.2	12.1	13.7	462.2	14.8
	LSD(0.05)	6.43	6.85	22.17	18.80	4.14	120.53	1562.36
	F-Test	**	**	**	**	**	NS	**

Table 4. Analysis for agronomic performance of maize genotypes conducted at Rampur during summer season of 2010

S. N.	Genotypes	Days to 50% tasselling	Days to 50% silking	Plant height (cm)	Ear height (cm)	Ear length (cm)	Ear diameter (cm)	Grain yield (kg/ha)
1	RML-7	53.50	55.50	193.50	96.50	12.60	3.82	3538.23
2	RL-84	50.50	53.50	173.00	86.50	15.30	3.98	6075.00
3	RL-30-1	59.50	59.50	178.50	104.00	13.20	3.56	2662.62
4	PUTU-13	61.50	64.50	152.50	74.00	13.90	3.50	1671.08
5	Pool-17	44.00	47.00	175.50	83.00	13.10	3.88	3180.73
6	Arun-1EV	43.50	47.00	161.50	85.00	13.40	4.30	1826.31
7	Arun-4	42.50	42.50	178.50	74.00	13.90	4.20	3268.88
8	Pool -16	43.50	45.50	170.50	82.00	12.20	3.85	2328.74

9	Narayani	43.00	47.00	154.50	91.50	15.00	4.01	3765.80
10	Upahar	55.00	57.50	201.00	100.50	14.10	4.59	4799.14
11	Across-9331	52.50	54.50	164.50	93.00	12.80	4.07	2509.84
12	S 97 TLYHGA YB (3)	48.00	49.50	195.50	96.50	12.40	3.95	2603.35
13	Rampur Composite	57.50	60.00	181.50	84.00	13.90	4.10	3786.43
14	Manakamana-4	48.50	49.50	193.00	86.50	14.00	3.95	6231.09
15	Arun-2	44.00	48.50	180.50	95.00	12.00	3.98	2827.34
16	OEHPW	61.00	64.50	207.50	102.50	14.80	4.07	3475.51
17	P 501/RCO/P 502 SRCO	62.00	64.00	179.50	79.50	12.80	4.24	3413.51
18	BGBY POP	63.00	66.00	183.50	96.00	14.30	4.17	3694.46
19	S99 TYQ-HGB	55.00	55.00	177.00	87.50	14.50	4.17	4628.91
20	Posilo Makai-1	60.50	65.00	199.00	100.50	14.80	4.20	5526.79
21	SO 1 SIWQ3	60.00	61.50	173.00	80.00	10.90	3.62	1439.12
22	S99 TLYQ-B	59.00	63.00	185.00	86.00	14.20	4.17	3693.95
23	Rampur SO 3 FO2	55.50	59.00	204.00	118.00	14.60	4.20	3442.71
24	Rampur SO 3 FO4	50.50	54.50	180.50	88.00	14.30	4.14	3656.57
25	Rampur SO 3 FO6	54.00	55.50	192.50	97.00	13.30	4.26	3000.80
26	Rampur SO 3 FQ-02	50.50	54.00	194.50	99.00	14.10	4.08	3420.71
27	BLSB SO7 F 10	54.00	55.50	178.00	88.00	13.90	4.33	3922.00
28	BLSB SO 7 F12	57.00	60.50	196.50	101.50	13.60	4.07	3749.69
29	TLBRS SO 7 F 14	54.00	56.00	194.50	90.50	14.80	4.39	4957.54
30	TLBRS SO 7 F 16	56.50	59.50	177.00	107.50	12.80	4.14	5238.60
31	R POP-1	57.00	59.50	205.00	98.50	13.60	4.55	4692.61
32	R POP-2	46.00	49.00	191.00	102.00	15.40	4.27	4672.19
33	R POP-3	54.00	56.00	181.00	97.00	16.60	4.58	3535.31
34	R POP-4	50.00	52.50	187.50	101.50	13.95	4.12	4315.39
35	NML-1/NML-2	54.00	55.50	185.00	98.50	13.80	4.46	3622.75
36	RML-4/NML-2	58.00	59.00	180.50	91.00	13.50	4.14	3553.51
37	RML-8/Rampur Composite	49.00	51.00	179.50	85.00	14.30	4.70	4182.87
38	Manakamana-3	57.50	59.50	192.00	103.50	15.10	4.20	3349.84
39	Rampur-2	50.50	52.00	177.50	80.50	15.60	4.17	3369.13
40	Deuti	58.50	61.50	187.00	91.50	15.20	4.11	3807.02
41	Pop-446	50.50	53.00	172.00	74.00	14.90	4.20	1164.25
42	Khumal Yellow	52.00	54.00	190.00	96.50	12.90	4.14	3672.85
43	Gulmi	53.50	55.50	236.50	132.00	15.30	4.27	3012.87
44	Resunga Composite	57.00	60.50	194.50	97.00	15.60	4.23	5000.25
	Grand mean	53.34	55.8	184.88	93.22727	13.98	4.14	3642.87
	CV(%)	6.8	7.1	9.7	16.3	17.4	6.28	39.2
	LSD(0.05)	4.23	4.67	19.85	16.01	2.70	0.493	1769.7
	F-test	**	**	**	**	*	NS	*

Table 5. Combined analysis on pest infestation experiment of maize conducted at three different locations (Rampur, Nepalgunj and Parwanipur) during summer season of 2010

S. N.	Genotypes	ASI (days)	Wilt %	Stem borer %	S. N.	Genotypes	ASI (days)	Wilt %	Stem borer %
1	RML-7	3.833	20.17	3.83	26	Rampur SO 3 FQ-02	3.5	2.33	0.0
2	RL-84	3	6.0	0.00	27	BLSB SO7 F 10	4.5	3.17	1.50
3	RL-30-1	2.5	1.17	5.0	28	BLSB SO 7 F12	2.5	6.0	0.83
4	PUTU-13	2.667	11.0	2.17	29	TLBRS SO 7 F 14	1.833	2.0	0.0
5	Pool-17	2.5	12.83	8.33	30	TLBRS SO 7 F 16	1.167	7.17	0.0
6	Arun-1EV	2.5	6.17	1.67	31	R POP-1	1.833	8.33	0.0
7	Arun-4	3.333	2.0	3.17	32	R POP-2	2.333	9.0	0.0
8	Pool -16	3.333	9.0	2.67	33	R POP-3	4.167	18.33	1.17
9	Narayani	1.833	3.83	0.83	34	R POP-4	2.833	8.33	0.83
10	Upahar	4.5	1.67	6.83	35	NML-1/NML-2	1.333	14.50	2.50
11	Across-9331	2.167	2.50	0.0	36	RML-4/NML-2	2.167	4.17	8.0
12	S 97 TLYHGA YB (3)	2	7.0	1.83	37	RML-8/Rampur Composite	1.833	3.0	0.0
13	Rampur Composite	3.167	8.50	0.0	38	Manakamana-3	4.167	7.0	0.0
14	Manakamana-4	4.333	1.50	7.17	39	Rampur-2	2.667	4.0	2.17
15	Arun-2	1.333	6.33	1.17	40	Deuti	5.167	4.67	0.0
16	OEHPW	2.167	7.0	0.72	41	Pop-446	3.333	10.33	0.0
17	P 501/RCO/P 502 SRCO	2.5	8.83	5.83	42	Khumal Yellow	3.833	6.33	0.0
18	BGBY POP	6.167	6.00	0.83	43	Gulmi	2.167	1.50	2.0
19	S99 TYQ-HGB	1	1.83	2.0	44	Resunga Composite	3.5	11.17	0.0
20	Posilo Makai-1	4.333	5.50	4.0		**Grand mean**	2.917	**7.11**	**1.94**
21	SO1 SIWQ3	2.5	11.17	0.0		CV(%)	44.02	131.67	266.64
22	S 99 TLYQ-B	1.833	19.0	0.83		SE	0.773	5.527	2.957
23	Rampur SO 3 FO2	3.167	6.33	2.33		LSD(0.05)	1.524	10.89	5.827
24	Rampur SO 3 FO4	3.167	10.83	2.33		F-test Genotypes (G)	**	*	NS
25	Rampur SO 3 FO6	3.667	5.17	2.67		Location (L)	*	NA	NS
						Interaction (G × L)	NS	NA	NA

CONCLUSION

Superior yield performance under high temperature conditions is an important and reliable index of high temperature tolerance. The maize genotypes namely Manakamana-4, Upahar, TLBRSSO7F16 and BGBYPOP performed equally better in all tested locations and their grain yields were found higher, hence they were promising genotypes under high temperature growing conditions based on findings of this research.

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