Evaluation of Full Season Maize Genotypes Planted Under Irrigated Hill Domain of Nepal

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Abstract: Varietal improvement and selection passes through a series of field experiments that includes Observations Nursery (OBN), Initial Evaluation Trial (IET), Coordinated Varietal Trial (CVT) followed by Coordinated Farmers' Field Trial (CFFT). Poor access to farmers' preferred high yielding open pollinated maize varieties and their effective dissemination has been one of the major concern over hill domain of Nepal. Field experiments were conducted to assess and select the elite full season open pollinated maize genotypes under central hill condition of Nepal during 2015 and 2016. The field experiments were assessed at Khumaltar, Lalitpur as coordinated varietal trial (CVT), tested in RCBD with three replications. Manakamana-3 was used as standard check while Khumal Yellow as Farmers' preferred check variety. From the field observation there were significant variations among the tested maize genotypes for various traits like, days to 50% tasseling and silking, plant and ear numbers per plot, evaluated over both the years. The most important trait, grain yield was also found significantly different among the tested full season maize genotypes over both the years. The highest productivity was observed for Rampur S03F08 (11.103 t/ha) followed by Rampur S13F28 (10.139 t/ha), Rampur S10F20 (9.343 t/ha) and Manakamana-3 (9.293 t/ha). The elite genotypes selected over both the years will be promoted in the further evaluation trials in subsequent years with regard to further verification and dissemination of the most promising farmers' preferred varieties over the hill domain of Nepal.

Keywords: *Varietal Improvement, Selection, Elite genotypes, Verification, Dissemination*

I. INTRODUCTION

Maize (*Zea mays L.*) is the second most important crop of Nepal after rice. This multipurpose crop is cultivated in 891,583 hectares of land with the production of 2,231,517 metric tons with the productivity of 2.5 t/ha (MoAD, 2017). It is traditionally a hill crop, mostly grown in the sloping *bari* land (rainfed upland) in the hill domain along with the lower river basin and lowland terai regions of the country. Maize cultivation is considered as a lifestyle for majority of farmers residing over the hill domain of Nepal (Adhikari et.al, 2000). More than 70 percent maize is grown in hilly areas and more than 90 percent of the area is covered by Open Pollinated Improved and Local Varieties of maize, (Pokharel et. al, 2004). Though cultivated in diverse environment from high hills and mid hills and terai regions from eastern to far western regions on Nepal, the production and productivity is very low as compared for the potentiality over global and even of the South Asian regions. The main constraint for developing country like Nepal is difficult topography, inaccessibility of resources like various inputs (improved seeds, in/organic manures, accessibility of timely irrigation and several biotic/abiotic stresses. There is always need for improvement of existing maize genotypes and development of new high yielding and stress tolerant maize varieties for wide range of adaptability targeting major maize growing domain of Nepal.

Since yield is a complex character, and the product of multiplicative interactions of a number of its component characters, it cannot be improved alone (Grafius, 1959). Hence, a clear picture of contribution of each component in final expression of complex character is essential (Kumar, 2011). Maize displays an orderly sequence of development of yield components as number of ear per plant, number of kernel per rows, number of kernel row per ear and hundred kernel weights (Webber, 1952). Thus, indirect selection can be used through searching for improved yield components. Grain yield is considered to have positive correlation with plant height, and hundred kernel weight (Ajmal, et.al., 2000) similarly days to silking showed positive correlation with grain yield per plant.(Afjal et.al, 2005).

II. RESEARCH METHODOLOGY

2.1 Meteorological information about the research site

Fourteen different full season maize genotypes were tested in the experimental field of Agriculture Botany Division for two consecutive summer seasons i.e. 2015 and 2016 at Khumaltar, Lalitpur condition. The trial field is located at an altitude of 1368 masl, 27 º 40'00" N latitude and 85º20' 00" E Longitude. The research site was climatically subtropical. The weather details of cropping season of both years 2015 and 2016 obtained from meteorological station of Agronomy Division situated at Khumaltar, Lalitpur, Nepal which are presented as below.

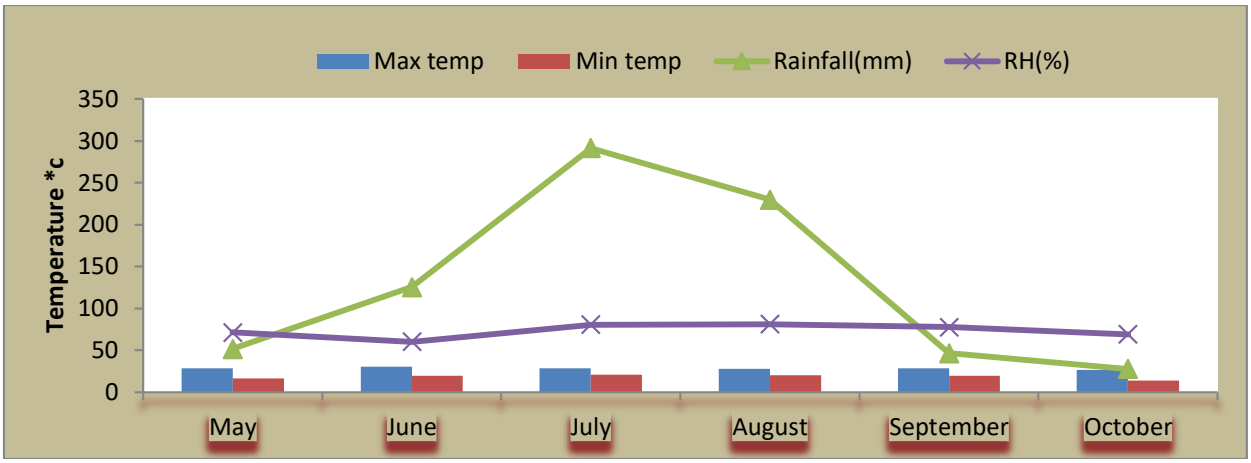

Figure1.Meteorological data during research period 2015.

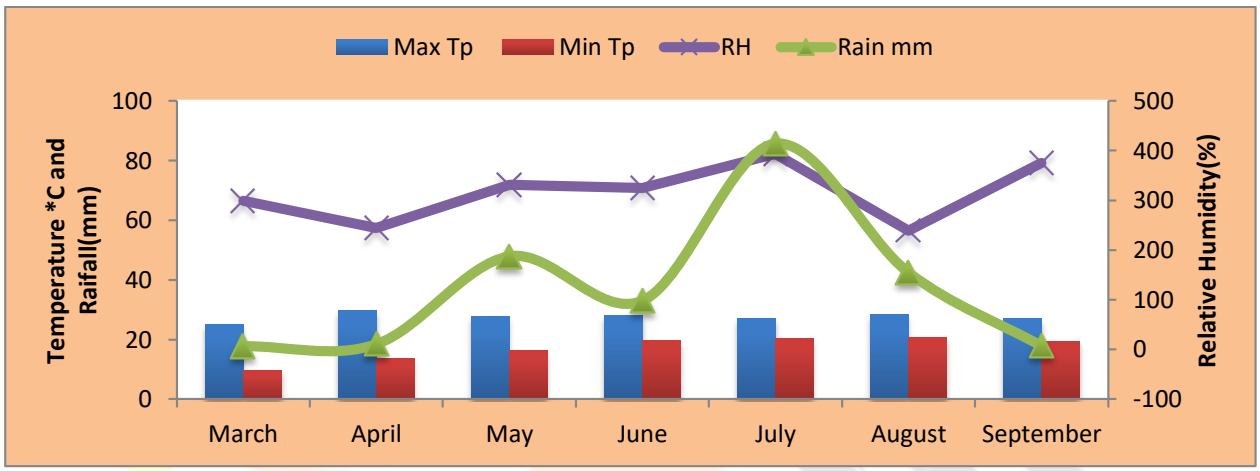

Figure2.Meteorological data during research period 2016.

2.2 Experimental Materials:

The experiment was carried out with fourteen full season maize genotypes in both years. The genotypes were: ZM627, Rampur S10F18, Rampur S10F20, R-POP-2, BLBSRS07F10, Rampur S13F28, Rampur S13F01, Rampur S13F030, Khumal Yellow (LC), HGA/HG-AB, KLYPOP, Manakamana-3, BLSBRS07F12 and Rampur S03F08. Among them, Khumal Yellow was local check and Mankamana-3 was used as standard check.

2.3 Experimental Design and Setup

The experiment was carried out in Randomized Complete Block Design (RCBD) and replicated thrice in each year. Altogether 14 genotypes in which Mankamana -3 was used as standard check and Khumal yellow as farmer's preferred variety as local check.

The trial was planted on 2nd week of June in each year. In addition to 10 FYM t/ha, chemical fertilizers were applied at the rate of 60:60:40 N:P_2O_5:K_2O kg/ha during final land preparation. Remaining 60 kg N/ha was top dressed in two splits, i.e. 30 kg N/ha at knee high stage and 30 kg N/ha at tasseling stage. The plot size was maintained by 3m × 3m (4 rows of 3m long) and yield and other data were taken from middle 2 rows. The crop geometry was maintained as 75 cm × 25 cm and two seeds per hill were sown. Thinning was done to maintain plant population after 3 weeks of germination. Furadan 3% was applied @ 3-4 granules/plant to control maize stem borer.

2.4 Data Recording

Major Qualitative and quantitative traits like plant and ear height, days to tasseling and silking, number of plants per hectare, number of ears per hectare and grain yield were recorded. Grain yield (kg/ha) was adjusted at 15% moisture content with the help of the below formula:

Grain Yield (kg/ha) = Field weight (kg/plot)*(100-HMP)*S*1000/ (100-DMP)*NPA

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, m2 S = Shelling coefficient which is taken as 80%. The above formula could be well utilized to adjust the grain yield (kg/ha) at 15% moisture content. This adjusted grain yield (kg/ha) and lastly tabulated as t/ha .

2.5 Statistical Analysis

The data recorded for different qualitative and quantitative traits from the experimental field were analyzed and tabulated from the utilization of GenStat and R software.

III. RESULT AND DISCUSSION

3.1 Mean performance and analysis of variance:

The mean values along with the analyzed data associated with yield and yield attributing traits have been presented in the following table 1 and 2 consequently. From the analyzed data significant results were obtained for Days to 50% tasseling, Days to 50% silking, Plant height (cm), Ear height (cm), plant per plot, ear per plot, agronomical aspects and yield.

Days to 50% Tasseling (DTT):

The results revealed that the genotypes were highly significant for days to 50% tasseling. The result indicated that genotypes BLBSRS07F10, Rampur S13F030, Khumal Yellow (LC) tasseled earlier in 61 and 62 days, respectively while the genotypes ZM 627 and Rampur S13F28 tasseled late in 67 days.

Days to 50% silking (DTS):

The genotypes were highly significant for days to 50% silking. Among 14 genotypes, seven genotypes viz. BLSBRS07F10, Rampur S10F18, Rampur S10F20, Rampur S13F030, Rampur S13F030, KLYPOP and BLSBRS07F12, were found with early silking. Days (63-64 days), while the genotypes ZM 627 and Rampur S13F28 were late in 68 days and 69 days, respectively.

Plant height cm (PH):

The genotypes showed highly significant variation in plant height (cm). The genotype Mankamana-3 was found as tallest genotype with 228.9 cm height, while the genotype Rampur S13F030 was found with the shortest height of 196.4 cm.

Ear height (EH):

The result revealed that the genotypes show highly significant variation on ear height (cm) with LSD value 13.85. The genotypes ZM627(90.7) and Rampur S10F20(96.1 cm) have the lowest ear heights as compared to the local check, Khumal Yellow which has the highest ear height 114 cm.

Plants per plot (PPL):

There was significant variation of plants per plot for all these genotypes. The genotypes Rampur S03F08, Mankamana -3 and KLYPOP were statistically at par with Local check variety Khumal Yellow with 20 plants per plot, while the genotype Rampur S13F018 and ZM627 has the lowest plants per plot 18.

Ear per plot (EPL): There was significant variation of ear per plant for all genotypes. The genotype Rampur S03F08 has the highest ears per plant followed by R-POP-2 and Rampur S13F28. Rampur S13F01 had the lowest ears per plant.

Table1: Evaluation of various quantitative traits of different full season maize during 2015 and 2016

Genotypes	DTT	DTS	PH	EH	PPT	EPT
ZM627	67	68	204.8	90.7	18	19
Rampur S10F18	63	64	197.4	96.1	18	20
Rampur S10F20	62	64	202.3	91.8	21	21
R-POP-2	62	64	208.3	110.7	20	22
BLBSRS07F10	61	63	205.3	103.4	20	20
Rampur S13F28	67	69	216.3	108.9	21	22
Rampur S13F01	64	66	209.6	92.7	11	12
Rampur S13F030	62	64	196.4	93.3	17	18
Khumal Yellow (LC)	62	64	222.0	114.9	19	21
HGA/HG-AB	63	65	213.8	104.0	20	21
KLYPOP	63	65	234.9	114.7	20	21
Manakamana-3	65	68	228.9	112.5	20	21
BLSBRS07F12	63	64	198.0	96.0	19	19
Rampur S03F08	64	66	217.4	103.5	22	26
Grand Mean	63.1	65.4	211.08	102.36	18.75	20.02
CV (%)	2.7	2.8	3.3	6.5	10.2	11.5
F Value						
Genotypes	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Year	0.799	0.766	<0.01	<0.01	<0.01	<0.01
G*Y	0.161	0.12	<0.01	<0.01	<0.01	<0.01
LSD						
Genotypes	1.96	2.109	7.969	7.673	2.21	2.674
Year	0.744	0.797	3.012	2.9	0.84	0.01
G*Y	2.78	2.983	11.27	10.851	3.13	3.781

DTT= Days to 50% Tasseling, DTS= **Days to 50% Silking, PH= Plant Height (cm),EH= Ear Height (cm), PPT= Plant/Plot, EPT= Ear/Plot**

Table2. Evaluation of various quantitative traits of different full season maize during 2015 and 2016

Genotypes	PA	EA	HCA	GLS	NLB	BLSB	YLD(t/ha)
ZM627	2.3	2.9	1.4	1.0	2.0	1.4	7.464
Rampur S10F18	2.2	2.8	1.2	1.0	2.6	1.3	7.367
Rampur S10F20	2.6	3.2	2.1	1.1	2.4	1.3	9.343
R-POP-2	2.1	2.8	1.2	1.0	2.7	1.3	8.271
BLBSRS07F10	2.1	2.7	1.0	1.0	2.6	1.4	7.992
RampurS13F28	2.3	2.8	1.3	1.0	2.3	1.3	10.139
RampurS13F01	2.4	2.9	1.2	1.0	2.4	1.5	6.138
RampurS13F030	2.8	3.8	1.2	1.0	2.3	1.3	5.026
Khumal Yellow	2.0	2.8	1.0	1.0	1.8	1.8	8.287
HGA/HG-AB	2.3	2.9	1.1	1.0	1.9	1.4	8.613

KLYPOP	2.8	2.8	1.8	1.0	2.6	1.8	8.359
Manakamana-3	2.0	2.2	1.0	1.0	1.8	1.4	9.293
BLSBRS07F12	2.7	2.8	1.1	1.5	2.3	1.3	6.441
RampurS03F08	2.2	2.3	1.0	1.0	2.5	1.3	11.103
Grand Mean	2.33	2.81	1.23	1.083	2.164	1.5	8.13
CV (%)	19.3	15.8	23	19.5	18	19.9	19.40
F Value	0.05	0.07	0.01	0.861	0.03	0.73	<0.01
Genotypes	0.037	0.052	0.01	0.003	0.01	0.01	<0.01
Year	0.109	0.458	0.442	0.877	0.064	0.607	0.08
G*Y	0.5193	0.514	0.3287	0.244	0.4508	0.346	1.822
LSD	0.1963	0.194	0.1243	0.092	0.1704	0.13	0.689
Genotypes	0.7344	0.727	0.4649	0.345	0.6375	0.489	2.576
Year	2.33	2.81	1.23	1.083	2.164	1.5	8.13
G*Y	19.3	15.8	23	19.5	18	19.9	19.40

PA= Plant Aspect, EA= Ear Aspect, HCA= Husk Cover Aspect, GLS= Grey Leaf Spot, NLB= Northern Leaf Blight, BLSB= Banded Leaf and Sheath Blight, YLD= Yield

Plant and Ear Aspect:

Rampur S13F030 is found best with plant aspect (2.8) and ear aspect (3.8) followed by Rampur S10F20 with PA and EA, 2.6 and 3.2, respectively better than local check Manakamana-3 with 2 and 2.2 respectively.

Disease Score:

All fourteen genotypes were statistically at par for GLS score. Genotype R-POP-2 was found comparatively more resistant to NLB followed by Rampur S03F08. Rampur lines were moderately resistant compared to local checks. While khumal lines: Khumal Yellow (LC) and KLYPOP were found more resistant to BLSB compared to Rampur lines.

3.2 Analysis of mean Yield performance of genotypes in two years:

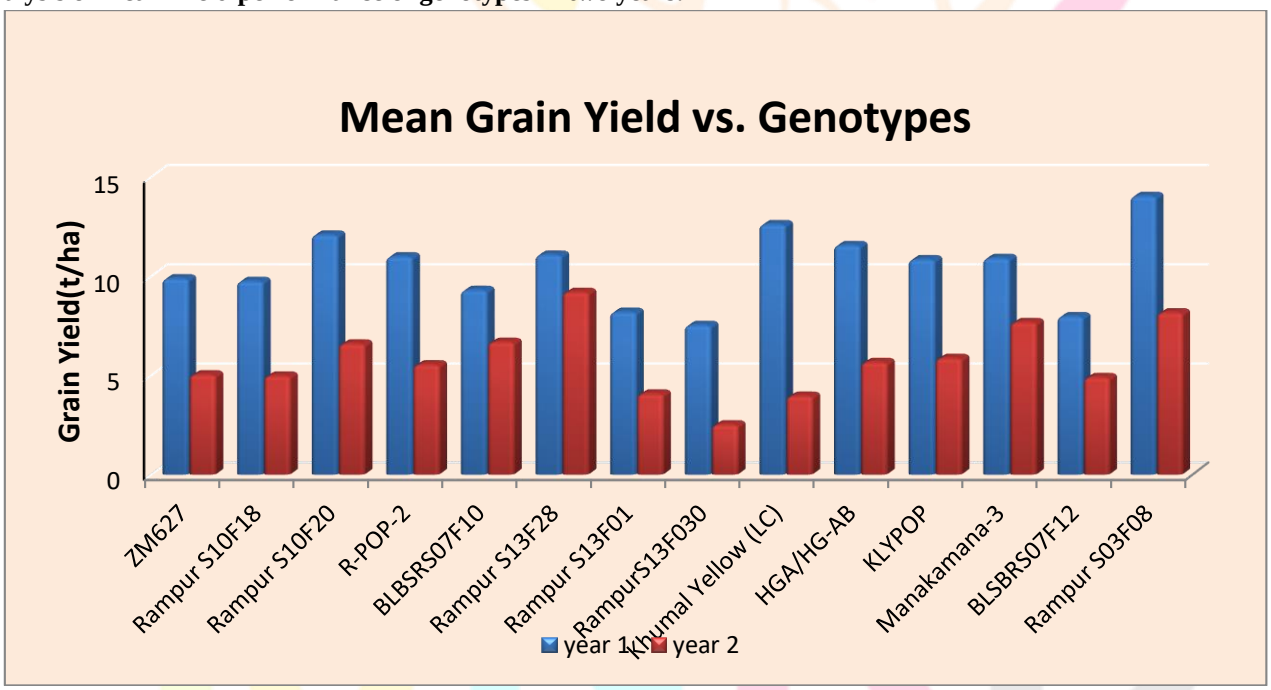

Figure 3. Mean grain Yield of genotypes in years 2015 and 2016.

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