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Research Article

Study on Different Germplasm of Early Summer Maize in Rampur, Chitwan, Nepal

I.P. Adhikari[1*], B. Osti[2], C.B. Kunwar[2], B.R. Ojha[3]

[1]Institute of Agriculture and Animal Science, Tribhuvan University, Rampur, Chitwan, Nepal
[2]National maize Research Program, (NMRP), Rampur, Chitwan, Nepal
[3]Agriculture and Forestry University, Rampur, Chitwan, Nepal

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***Corresponding author**
I.P. Adhikari,
Institute of Agriculture and Animal Science, Tribhuvan University, Rampur, Chitwan, Nepal
Email: adhikariindra1995@gmail.com

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Abstract

Fourteen different germplasms of early summer maize (*Zea mays* L.) were tested for their production potential. The main objective of this research was to see the productivity of these varieties on local condition, their phenotypic characters, and their relationship with yield. Fourteen trails with three replications were randomized with RCBD. Observation and data recording were done by field visiting. Among the observed quantitative parameters; Cob diameter, Cob length, Row number per cob, Grain number per row, 300 grain weight at 14% moisture shows positive and significant correlation with the yield whereas Days to 50% silking, Days to 50% tasseling, and plant height shows positive but non –significant correlation with the yield. COMPOZ-NI-PB, S03TEY-POBM, and EEYCL were seen more productive than the released variety of NMRP: Arun-4 on the local condition.

Abbreviations: National maize research program (NMRP); Randomized Complete Block design (RCBD).

Keywords: Germplasm; phenotype; quantitative; correlation; silking; tasseling.

Introduction

Maize (*Zea mays* L.) is a member of grass family poaceae. It is a monoecious, annual grass with overlapping sheaths on conspicuously distiches blade. It was believed to be originated from Central America and southern Mexico (Alvi *et al.*, 2003). In Nepal, maize is the second most important crop after paddy, in terms of both production and productivity. Maize is cultivated for food, feed and fodder at both irrigated and non-irrigated conditions (Gauchan *et al.*, 2018). The demand of maize is increasing in past decade mainly for poultry feed industry and uprising human population (Paudel and Matsuoka, 2009). 98 gm/person/day is the per capita maize consumption in Nepal (Govind *et al.*,

2015). At present, the Maize sown area in Nepal is 928,761 ha with a total production of 2,283,222 metric tons and productivity of 2,458 Kg ha^{-1} (Gauchan *et al.*, 2014, Chaudhari). In Chitwan, maize is cultivated on total area of 9,750 ha with the total production of 29,250 metric tons and productivity of 3,000 Kg ha^{-1} (Gauchan *et al.*, 2018, Chaudhari). Selection of superior yielding population of maize is very fruitful task for all maize plant breeders (Malik *et al.*, 2005). The study was conducted to determine the genetic variability among the different maize genotypes. The results from this investigation would serve as a guide to plant breeders to initiate an improvement program. The analysis of genetic diversity provides maize breeder and researchers with useful information for germplasm preservation and the identification of group of inbred lines and other breeding materials that may be exploited by the production of highly heterotic hybrids (Kashiani *et al.*, 2010).

Material and Methodology

Plant Materials and Details of Experiment

Fourteen genotypes were used in the research, as provided by the National maize research program. This field experiment was conducted at the land of NMRP during 2015 June 5 -2015 august 14. It is located at 27^0 40^I N latitude, 84^0 19^I E longitude and 228 meter above mean sea level. The land was divided into 42 different plots with the plot size of 5*3 m^2. Each treatment (genotypes) was subjected to three different replications. In each plot 8 rows of plants were made with the row to row spacing of 75 cm and plant to plant distance was maintained 25cm. Land preparation was done 15 days prior to sowing of seeds. Two ploughing fallowed by labeling was done and manure application was also done at the time of ploughing at the rate 10 ton per hectare. Sowing was done on 5^{th} of June. After sowing fertilizers were applied in the ratio of 120:60:60 N: P: K kg/ha. Of which all dose of phosphorous and potassium and half dose of nitrogen were applied at the time of sowing. The remaining dose of Nitrogen was split into two halves and applied as foliar spray at 15 and 30 days after sowing respectively. Two weeding were done at 25 and 50 days after sowing. Irrigation was done at critical plant stages (knee height, tasseling, silking, milk stage, and doughing in maize) and also according to the soil condition and soil water demand. Harvesting was done on 14^{th} of august. Harvesting was done separately for each plot and analyzed independently.

Experimental Layout

Land was made in RCBD, three replications were made with each having plot size of 3*5 m^2. The land was oriented in east-west direction.

Collection of Data

We have collected different data as needed and recorded them, the data we recorded under different headings are mentioned below.

1. **Days to 50% tasseling: -** This data was taken by making the field observation. As the half of the plants on the plot gets tasseled, the date was recorded. Only those plants were considered as tasseled which have its tassel came up and bloom to show the flowers.
2. **Days to 50% silking: -** This data was also taken by making the field observations, As the half of the plants on the plot get silked the date was recorded,
3. **Plant height: -** When the plants were completely matured and the cobs were harvested the data was taken, with the help of the scale the height were taken, 10 plants were randomly selected and avg. the data taken. Height was taken from the root to the tassel head, and was in cm.
4. **Ear height: -** Just before the cobs were harvested the measurement was taken with the help of a measuring scale, we took randomly 10 plants and avg. their height. Height was taken from the root to the ear where it comes out from. Measurements were taken in cm.
5. **Root lodging: -** before the harvesting a field survey was done and the plants with root lodging were recorded, root lodging was supposed to be physical weakness so the plants gets lodged from the root which ultimately results in lower production.
6. **Shoot lodging: -** This also was supposed to be a production lowering factor, those plants which were lodged other than above the root were known to be shoot lodged. These were also recorded prior to harvesting.
7. **Test weight @ 14% moisture: -** After harvesting the moisture content of the grains were recorded and left to dry, after certain time interval the moisture fall down to 14% and 300 grains were counted and measured precisely. Those 300 grains were selected in random.
8. **Number of rows per cob: -** After harvesting the cobs were selected randomly at the number of 10 cobs per plot, then those cobs were dehusked and the rows were counted at the middle of the cob.
9. **Number of grains per row: -** Apparently on a cob we found various diversification on this parameter; selection of 5 random rows from a cob, and 10 cobs were taken and at last average of those numbers were calculated.

10. **Cob length: -** 10 cobs as previously selected were taken for this data as well. A vernier scale was used for the measurement of length. Measure was taken from the bottom of the cob (from where the grains started) to tip of the cob. And average was made.
11. **Cob diameter:** - vernier scale was placed at the middle of the cob. 10 cobs as previous were recorded and average was made.
12. **Yield per plot:** - harvesting was done and the harvest was dried to 14% moisture and weighing per plot was done. This was the most needed character as all other parameters are studied to know their relationship with the yield.

Statistical Analysis

The mean data from each plot were taken for statistical analysis. Genotypes were considered as fixed effect and replication was assumed as random effect. The data was analyzed using R-stat (ANOVA, dmrt, histogram), excel (bar diagram), SPSS (correlation coefficient), and Microsoft office 2010.

ANOVA table was used to determine the significance of the study of those parameters. For days to 50% tasseling highest mean was observed to be 51.33 for Across-99402 and COMPOZ-NIPB and lowest was observed as 44.33 in Arun-4 (standard check). The ANOVA table shows the data to be significant at 5% of error. For days to 50% of silking highest mean was observed to be 55 days for Across-99402 and likewise lowest mean was observed to be 50.00 days on R.C./POOL-17 and S97TEYGHAYB (3), and the result was significant at 95% of significance. Similarly, for plant height highest was observed in Arun-4 as 186.667 cm and lowest was observed in S03TEY/LN as 136.67cm and ANOVA gives the insignificant result for this parameter. For ear height highest was observed in Arun-4 as 90 cm and lowest was found to be 63.33cm in Across-99402 this analysis was also found insignificant. For root lodging highest was observed In Arun-4 and lowest was observed in ZM-621/Pool-15and ANOVA gave an insignificant result. For shoot lodging highest mean value was found to be 5 in SO3TEY-LN/PP and no shoot lodging was found in ZM-621/Pool-15, similarly for cob length, cob diameter, row number per cob and grain number per row highest mean were observed in FARMERS VARIETY, COMPOZ-NIPB, SO3TEY-PO-BM and EEYC1 as 14.47 cm, 3.96 cm, 14.00 and 29.67 respectively and study shows a significant result for all. For test weight of 300 grains at 14% moisture level COMPOZ-NIPB was found to be at the top with 0.137 kg and lowest was found to be 0.0935 kg in SO3TEY/LN.

Result and Discussion

Main Yield

The mean experimented grain yield per hectare was 617.3513 kg/ha. Highly significant differences in tested genotypes were recorded COMPOZ-NIPB produced highest grain yield per ha (1049.3085), while across-99402 produce lowest yield. So3TEYPO-BM, Farmers variety, EEYC1 & COMPOZ-NIPB shows relatively more yield than ARUN-4 (STD CHK). A study on far western region of Nepal also showed So3TEY/LN, and So3TEY- ER as promising varieties for those regions (Prasai *et al.*, 2015). When a certain genotype perform ideally in the given location that is considered as the most suitable variety for the location (Yan and Kang, 2002). In this condition, So3TEY PO-BM is the best for the Rampur location. Various genetic components acts different in different location, thus it impacts the performance as yield (Obi, 1991; Yan and Rajcan, 2002). Similarly, Rampur environment is suitable for So3TEYPO-BM, Farmers variety, EEYC1 and COMPOZ-NIPB, but this doesn't suggest that, these varieties are always superior as comparison to other.

Correlation Coefficient

After analysis of correlation coefficient of yield related traits with grain yield following relation has been obtained. Regression equation shows the relationship between the grain yield ha^{-1} with variables traits i.e. days to 50% silking, days to 50% tasseling, plant height, ear height, root lodging, shoot lodging, plant per plot, ear per plot, cob length, cob diameter, row number, grain number, field weight, test weight. Among them, days to 50% silking, days to 50% tasseling plant per plot, ear per plot, cob length, cob diameter, row number, grain number, field weight, test weight shows positive correlation with grain yield ha^{-1}. Similarly, plant height, ear height, root lodging, and shoot lodging days showed negative correlation with grain yield ha^{-1}. The pair wise simple correlation coefficients among various yield components have been presented in the following graph. After analysis of correlation coefficient yield related traits with grain yield following relation has been obtained. Regression equation shows the relationship between grain yield ha-1 with following traits i.e. Days to 50% tasseling, Days to 50% silking, Plant height, Ear height, Root lodging, Shoot lodging per plot, Cob length, Cob diameter, Row number cob, Grain number per row, Five hundred-kernel weight. Among them Days to 50% tasseling, Days to 50% silking Plant per plot, ear per plot, Cob length, Cob diameter. Row no. Grain number per row, five hundred kernel weight shows a positive correlation with the yield. Similarly, Plant height, Ear height, Root lodging, shoot lodging plant per plot showed negative correlation with Grain yield per hectare. The pair wise simple correlation coefficient among various yield components have been presented in the table. A study in Rampur in 2013 also stated that ear length and test weight of the grains have the highest effect on yield (Pariyar *et al.*, 2015), Similarly a study conducted in Pakistan, Russia and with the maize heterosis study also had the similar results

(Yousuf and Saleem, 2001, Tollenaar *et al.*, 2004, Khakim *et al.*, 1998) as per ours. In contrast to the results, plant height showed a positive correlation with yield on a study conducted by Kashini in 2010 (Kashiani *et al.*, 2010), while short height was shown preferable for higher yield on a study in India (Mohan *et al.*, 2002).

From the Table 1, we studied the correlation of different yields and yield related traits and their relation to increase grain yield From the table ,days to tasseling has positive correlation with days to silking and highly significant(0.986**) and negatively correlated and significant with plant height(-0.336*) and negatively correlated with year height but highly significant(-0.480*), negative correlation with Root lodging and significant (-0.356*)and positive correlation with grain yield (0.07). Plant height showed positive correlation with year height and highly significant (0.773**) and positive correlation with root lodging (0.10) Ear height showed positive correlation with root lodging and shoot lodging. positively correlated with cob length and highly significant (0.568**) positively correlated with cob diameter and highly significant(0.537**), positively correlated with grain yield per hectare and highly significant(0.688**).Row number shows positive correlation with grain number per row and highly significant (0.505**), positive correlation with five hundred kernel weight and highly significant (0.516**) and positive correlation with grain yield per hectare and highly significant (0.487**) . Five hundred kernel weigh shows positive correlation with grain yield and significant (0.392*).

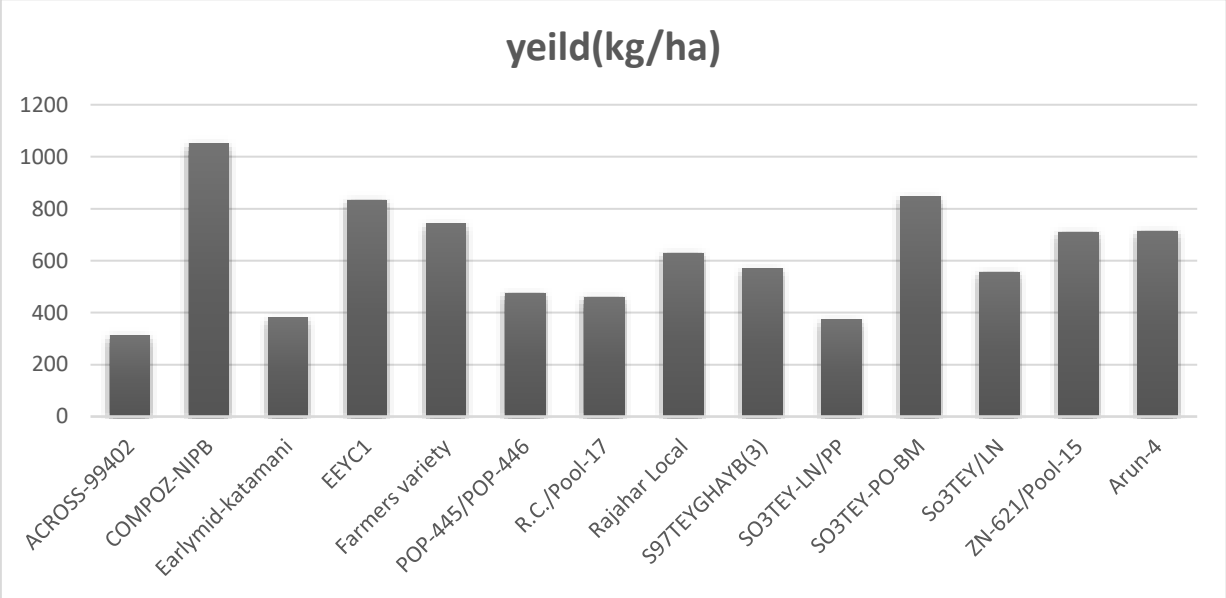

Fig. 1: Main yield of the different landraces calculated per hectare is shown in this figure. Arun- 4 being the standard check (first from the right).

Table 1: Correlation coefficient

	DT	DS	PH	EH	RL	SL	CL	CD	RPC	GPR	TW	GY
DT	1											
DS	.98**	1										
PH	-.36*	-.34*	1									
EH	-.48*	-.48*	-.77**	1								
RL	-0.35	-0.31	0.10	0.17	1							
SL	-0.28	-0.25	-0.15	0.12	0.03	1						
CL	0.15	0.13	0.01	-0.27	-0.12	-0.08	1					
CD	0.16	0.13	0.07	-0.15	-0.04	-0.15	.54**	1				
RPC	0.15	0.11	-0.08	-0.26	-0.17	-0.24	.36*	.39*	1			
GPR	0.04	0.03	0.07	-0.18	-0.04	-0.04	.81**	.50**	.43**	1		
TW	0.07	0.05	0.13	-0.07	-0.25	-0.11	.41**	.51**	0.10	0.28	1	
GY	0.07	0.04	0.17	-0.03	-0.12	-0.21	.42**	.48**	.50**	.51**	.392*	1

(Lower diagonal P value table) DT- days to 50% tasseling, DS- days to 50% silking, PH- plant height, EH- ear height, RL- row length, SL-shoot length, CL- cob length, CD- cob diameter, RPC- row per cob, GPR- grains per row, TW- test weight of 3oo grains at 14% moisture, GY- grain yield, *- significant at 95%,**- significant at 99% .

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