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Agronomic performance and genotypic diversity for morphological traits among early maize genotypes

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Abstract

Detailed information on the genetic diversity between maize germplasm (*Zea mays* L.) is useful for their systematic and efficient use in breeding programs. Fourteen early maize genotypes were studied to assess their performance and genotypic diversity at Doti, Nepal in 2015. Days to tasseling, days to silking, plant height, ear height, ear length, ear diameter and grain yield were significant among genotypes. Genotype SO3TEY-PO-BM, COMPOL-NIOBP and ACROSS-99402 were found higher yielder with earlier maturity. Days to tasseling (0.85), days to silking (0.82), plant height (0.79), ear length (0.71) and ear diameter (0.66) were found highly heritable traits. Grain yield (0.39) and ear height (0.47) medium and remaining traits showed low heritability. High PCV was observed for grain yield (35.10%), number of plants/plot (34.46%), tesseling silking interval (26.85%), harvested ears/plot (24.45%) and husk cover rating (22.85%) where other traits showed medium to low PCV. Grain yield showed high GCV (21.96%), ear height and husk cover had medium and remaining traits showed low GCV (<10%). Plant height ($r_=0.498$), harvested plants/plot ($r_=0.412$), harvested ear/plot ($r_=0.762$), ear length ($r_=0.472$) and ear diameter ($r_=0.470$) showed significant positive correlation with grain yield. The yield can be improved if selection applied in favor of those yield components.

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Introduction

Maize (*Zea mays* L.) is second important crop after rice in Nepal. It is cultivated in 891583 ha with 2503 kg/ha national productivity (MOAD, 2017). The majority of the maize area lies in the mid hills across the country where it is the first principal staple food and feed crop and produce about 70% of national maize production. Therefore maize can be considered as source of livelihood for hilly farmers. It is a traditional crop cultivated on slopping upland terraces (bariland) in the hills under rainfed condition during the summer on which fingermillet is relayed in majority, however sole maize was dominantly followed by wheat. Hilly areas of western Nepal is mostly food deficit, drought prone areas where annual

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average rainfall is about 1000 mm and rainfall distribution is erratic and unpredictable. Lower productivity of maize is associated with lack of suitable varieties for stress environments, inadequate variety in the existing system, lack of agricultural inputs like irrigation, fertilizers etc. Early maturing maize will also ensure for timely wheat sowing in maize-wheat system which may lead proper germination and initial growth of wheat because wheat is grown on residual moisture and if sown late germination and growth may be adversely affected due to lack of moisture in bariland farming. In addition early maturing maize also compete less with fingermillet for sunlight, nutrients and moisture than full season maize in maize/millet relay cropping with ultimately support to increase fingermillet yield. Thus improved maize genotypes with early maturity and high yield, tolerant to drought and better fit into existing system will increase and stabilize yield of maize, fingermillet and wheat on bariland farming system of hilly areas.

Variability is the differences between individuals in a population due to genetic composition and growing environment (Sumanth et al., 2017). The existence of variability is utmost role as success of any plant breeding program depends on the genetic variability and selection skill of plant breeder (Adhikari et al., 2018). Selection is only effective if the parent population have significant amount of variability. Phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) provides insight information on magnitude of variability in a population and heritability shows the component of a character transmitted to future generations (Pal et al., 2016; Girma et al., 2018) Further, heritability coupled with genetic advance shows the expected genetic gain in next generation (Shukla et al., 2006). In addition, correlation between yield and yield attributing traits are prime important for indirect selection for those traits which have high heritability and closely associated to contributes to improve yield (Aditya & Bhartiya, 2013). Therefore, the study was under taken to identify suitable early maturing genotypes and to know the information on variability, heritability, genetic advance and traits correlation on tested materials to utilize it on future maize breeding activity which aim to develop suitable genotype for rainfed bariland farming of mid hills areas of Nepal.

Materials and Methods

Experimental Location

The experiment was conducted at Regional Agricultural Research Station, Dipayal, Doti. Geographically, it is situated at 80° 55' east longitude and 29° 15' north latitude and the altitude of this station is 510 masl (RARS, 2015). The climate is sub tropical, generally monsoon starts late in July and it is erratic with average annual rainfall of about 900mm. Experimental field soil was shallow in depth and porous, sandy loam, slightly acidic with pH 5.5-6.0, low in nitrogen and organic matter i.e. 1-2% and 0.6 % respectively and the water holding capacity of the soil is very low (RARS, 2015).

Genotypes

The experiment was carried out with fourteen different early maize genotypes in which 13 were received from National Maize Research Program (NMRP), Rampur and Farmer’s variety was collected from Dipayal, Doti. The tested genotype were: Earlymid Katamani, Rajahar Local, S97TEYGHAYB(3), POP-445/POP-446, COMPOL-NIBP, RC/POOL-17, S03TEY/LM, Arun-4 (standard check variety), Farmer’s variety (local check variety), ZM621/POOL-15, EEYC1, SO3TEY-LN/PP, SO3TEY-PO-BM and Across-99402.

Experimental Design and cultural practices

The experiment was planted on 2nd week of June in Randomized Complete Block Design (RCBD) with three replications. Along with FYM @ 10 t/ha chemical fertilizers at the rate of 60:60:40 N P_2O_5 K_2O kg/ha in the form of Urea, DAP and Murate of Potash were applied during final land preparation. Top dressing was done by 60 kg N/ha in two splits, i.e. 30 kg N/ha at knee high stage and 30 kg N/ha at just before tasseling stage. Individual plot size was 3m × 3m (4 rows of 3m long). Seed was shown @ 2 seeds/hills in 75 cm apart rows by maintaining 25 cm between hill to hill in a row. Thinning was done to maintain plant population after 3 weeks of germination. Intercultural operations were done as per recommendation of National Maize Research Program.

Data measurement

Days to tasseling, days to silking, number of plants harvested, number of cob harvested, field weight were taken from central 2 rows from each plot. Five plants form central rows randomly selected and plant height, ear height, ear length, ear diameter recorded and mean values was taken for analysis. Husk cover rating was taken as 1-5 scale where 1 is good and 5 is poor. After taking field weight, composite grains from five randomly selected ears prepared and moisture reading taken for thrice and mean was used for yield estimation. Grain yield was estimated at 15% moisture and 80% shelling coefficient by below formula which was also adopted by Carangal et al. (1971) and Shrestha et al. (2018).

$$\text{Grain yield } \left(\frac{\text{kg}}{\text{ha}}\right) = \frac{\text{F.W.}\left(\frac{\text{kg}}{\text{plot}}\right) \times (100 - \text{HMP}) \times \text{S} \times 10000}{(100 - \text{DMP}) \times \text{NPA}}$$

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, m^2
S = Shelling coefficient, i.e. 0.8

Data analysis

Analysis of variance and correlation among traits were done by using Genstat 18th edition at 0.05 level of significance. Likewise significance of correlation coefficient was done as proposed by Kothari (2004). The phenotypic and genotypic variances were computed according to Falconer (1981). Broad sense heritability was calculated using formula suggested by Allard (1960) and categorized as low (0-0.3), moderate (0.30-0.6) and high (>0.6). The estimates of genetic advance were obtained at 5% selection intensity and categorized as high (>20%), medium (10-20%) and low (<10%) as suggested by Johnson et al. (1955). Coefficient of genotypic and phenotypic variation were also categorized as high (>20%), medium (10-20%) and low (<10%) as proposed by Sivasubramanian and Madhavamenon (1973).

Results and Discussion

Analysis of Variance

The analysis of variance for 10 quantitative characters showed significant differences among the evaluated genotypes for days to tasseling, days to silking, plant height, ear height, ear length, ear diameter and grain yield. However, differences were not significant for tasseling silking interval days, number of harvested plants/plot, number of harvested cobs/plot and husk cover rating (Table 1 and 2). Statistical traits indicated the existence of inherent genetic variation among tested genotypes for those traits. Thus there is scope to enhance genetic yield potential through selection and hybridization. Existence of significant genetic variability among maize genotypes for yield and major yield attributing traits were reported by Vashistha et al. (2013), Ogunniyan and Olakojo (2014), Pahadi and Sapkota (2016), Bhusal et al. (2017), Kandel et al. (2018) and Sharma et al., (2018). Prasai et al. (2015) also reported genetic variability on early maize. Similarly, Shrestha (2014) observed morphological variation in maize inbred lines in Chitwan, Nepal.

Agronomic performance

Agronomic performance observed on yield and yield attributing characters were summarized and presented in Table 1 and 2.

Days to tasseling, silking and tasseling silking interval

Genotypic differences were observed significant for both days to silking and tasseling but the interval between silking and tasseling remained statistically non-significant. The silking tasseling intervals remained 2-3 days for all tested genotypes. Farmers variety observed earliest in tasseling and silking took 37 and 40 days respectively which was followed by S97TEYGHAYB(3) and Arun-4 both took 45 and 48 days respectively for tasseling and silking. Genotype S03TEY/LM observed late took 51 days for tasseling and 53 days for silking. This observation clearly indicated that farmer's variety is extra early and could be one of the parents for maize hybridization program to develop early maturing variety. Significant difference among tested maize genotypes for days to tasseling and silking were previously reported by (Vashistha et al., 2013; Prasai et al., 2015; Sharma et al., 2018; Bhusal et al., 2017).

Plant and ear height

Significant differences for plant and ear height observed indicated the existence of genetic variability among genotypes kept under study. Rajahar Local was the tallest genotype in plant height (287 cm) and ear height (126 cm) whereas farmers' variety was observed as dwarf genotypes. Standard check variety (Arun-4) and ZM621/POOL-15 were found medium in plant and ear height. In favor of present study, genotypic variation on plant and ear height were previously reported by (Ogunniyan and Olakojo, 2014; Parsai et al., 2015; Sharma et al., 2018).

Plant and ear harvested

Tested genotypes were not differed statistically for number of plants and ear harvested per unit area. Mean harvested plants and ear were found 14 and 16 respectively. Similar result on harvested plant and ears on early maturing maize were reported by Katuwal et al. (2017).

Ear length, diameter and Husk cover rating

Genotypic differences were observed for ear length and diameter but rating based on husk cover remained at par between genotypes. Across-99402 was observed highest ear length and farmer's variety was shortest ear length. Likewise, genotype ZM 621/POOL-15 was found having highest ear diameter while farmer's variety was lowest. Husk cover rating was observed 2-3 for all genotypes. Genetic difference on ear length and diameter were also reported by (Vashistha et al., 2013; Pahadi & Sapkota, 2016).

Grain Yield

The grain yield was found statistically significant indicating the existence of genetic variability on yield potential on the tested genotypes. Higher yielder genotypes observed were SO3TEY-PO-BM, COMPOL-NIOBP, ACROSS-99402 could be selected as promising genotypes for early maturing groups or may be used as a parent in maize breeding program to develop early maturing maize varieties. Likewise, farmer's variety was poor yielder but due to its early maturing character it can also be used as a parent for the purpose. Genetic variability on maize genotypes was reported by many authors including (Vashistha et al., 2013; Bhusal et al., 2017; Katuwal et al., 2017).

Genetic parameter estimation

Estimated genetic parameter such as the phenotypic coefficient of variation (PCV), the genotypic coefficient of variation (GCV), broad sense heritability, and genetic advance as percent of means are presented in Table 3. Yield and yield attributing traits under study showed higher phenotypic coefficient of variance than genotypic coefficient of variance indicated high environmental influence on the expression of these trait, however, as compared with others, less environmental influence was observed for days to silking, tasseling and plant height. Similar results were presented by (Pahadi and Sapkota, 2017; Bisen et al., 2018; Sharma et al., 2018). High PCV was observed for grain yield, number of plants/plot, tesseling silking interval, harvested ears/plot and husk cover rating where as remaining traits showed medium to low PCV. Similarly high GCV was estimated for grain yield, medium for ear height and husk cover rating and remaining traits showed low GCV. In line with this findings high PCV and GCV for grain yield was also reported by (Ogunniyan and Olakayo, 2014; Bhusal et al., 2017; Bisen et al., 2018; Sharma et al., 2018).

Table 1. Mean performance of yield attributing traits on maize

SN	Genotype	DT	DS	TSI	PH	EH
1	Early Mid Katamani	50^{fg}	52^{def}	2.33	250^{def}	100^{abcd}
2	Rajahar Local Variety	48^{bcdf}	50^{bcde}	2.67	287^{g}	126^{d}
3	S97TEYGHAYB(3)	45^{b}	48^{b}	3.00	211^{ab}	75^{a}
4	POP-445/POP-446	46^{bcde}	49^{bcd}	3.67	222^{bc}	78^{ab}
5	COMPOL-NIBP	50^{fg}	53^{ef}	3.00	232^{bcd}	77^{ab}
6	RC/POOL-17	47^{bcdef}	50^{bcd}	2.33	251^{def}	111^{cd}
7	S03TEY/LM	51^{g}	53^{f}	2.33	256^{ef}	107^{cd}
8	Arun-4	45^{bc}	48^{bc}	3.00	245^{cde}	106^{cd}
9	Farmer's Variety	37^{a}	40^{a}	2.67	195^{a}	75^{a}
10	ZM621/POOL-15	48^{cef}	51^{cdef}	3.00	241^{cde}	97^{abc}
11	EEYC1	45^{bcd}	48^{b}	2.67	271^{fg}	101^{abcd}
12	SO3TEY-LN/PP	49^{fg}	52^{def}	2.33	253^{def}	96^{abc}

13	SO3TEY-PO-BM	49^{fg}	52^{def}	3.00	273^{fg}	102^{bcd}
14	ACROSS-99402	49^{fg}	51^{def}	2.33	233^{bcd}	90^{abc}
	Mean	47	50	2.74	244	96
	SEM	1.17	1.24	0.57	9.97	11.14
	P value	<.001	<.001	0.534	<.001	0.002
	CV%	3.0	3.1	25.9	5.0	14.2
	LSD (0.05)	2.4	2.56		20.48	22.9

Means followed by a superscripted common letter with in a column are not significantly different from each other at $P \leq 0.05$. DT= Days to tasseling, DS= Days to silking, TSI= Tasseling silking interval, PH= Plant height (cm), EH=Ear height (cm)

Due to the lower differences estimated between PCV and GCV selection based on phenotypic performance for days to tasseling, silking and plant height would be effective to bring about considerable genetic improvement on the tested maize population for these traits but agronomic performance can't improve by providing favorable environment without selection. Traits showing higher difference between GCV and PCV indicated that these traits are more influenced by growing environment thus selection is not effective on those traits, can be maintained by providing optimum growing environment.

Table 2. Mean performance of grain yield and yield attributing traits on maize

SN	Genotypes	P/P	E/P	EL	ED	HC	GY
1	Early Mid Katamani	14	16	14.00^{bc}	4.20^{bc}	3.00	2945^{abcd}
2	Rajahar Local Variety	18	17	13.33^{b}	4.17^{b}	2.67	3013^{abcd}
3	S97TEYGHAYB(3)	19	17	14.33^{bcd}	4.37^{bcde}	2.67	3109^{bcd}
4	POP-445/POP-446	11	13	14.00^{bc}	4.40^{bcde}	2.67	2225^{ab}
5	COMPOL-NIBP	14	18	14.67^{bcd}	4.60^{ef}	2.33	4179^{d}
6	RC/POOL-17	15	15	13.67^{b}	4.40^{bcde}	3.00	2299^{ab}
7	S03TEY/LM	9	17	14.67^{bcd}	4.53^{ef}	3.00	3409^{bcd}
8	Arun-4	15	14	14.00^{bc}	4.20^{bcd}	2.67	2834^{abcd}
9	Farmer's Variety	10	11	10.00^{a}	3.87^{a}	2.00	1409^{a}
10	ZM621/POOL-15	14	11	14.33^{bcd}	4.77^{f}	2.33	2392^{abc}
11	EEYC1	18	18	14.33^{bcd}	4.50^{cef}	2.00	3880^{bcd}
12	SO3TEY-LN/PP	14	18	14.00^{bc}	4.37^{bcde}	2.00	3522^{bcd}
13	SO3TEY-PO-BM	14	17	15.33^{cd}	4.60^{ef}	2.00	4333^{d}
14	ACROSS-99402	18	18	15.67^{d}	4.63^{ef}	2.33	3976^{cd}
	Mean	14	16	14.02	4.40	2.48	3108.93
	SEM	3.91	2.97	0.64	0.13	0.41	695.1
	P value	0.314	0.273	<.001	<0.001	0.108	0.01
	CV%	33.2	23.3	5.6	3.6	20.4	27.4
	LSD (0.05)			1.32	0.26		1428.8

Means followed by a superscripted common letter with in a column are not significantly different from each other at $P \leq 0.05$. P/P= Number of harvested plants/plot, E/P= Number of harvested ears/plot, EL= Ear length (cm), ED= Ear diameter (cm) HC= Husk cover rating in 1-5 scale, GY= Grain Yield kg/ha

Among the studied traits broad sense heritability ranged from 0.04 (TSI) to 0.85 days to tasseling. Heritability is grouped as low (<0.3), moderate (0.3-0.6) and high (>0.6). Based on this category days to tasseling, days to silking, plant height, ear length and ear diameter were found highly heritable traits. Grain yield and ear height medium and remaining traits showed low heritability. High heritability for days to tasseling, days to silking, plant height, ear length and ear diameter and high to medium for grain yield were also reported by (Vasistha et al., 2013; Bhusal et al., 2017; Sharma et al., 2018). Medium heritability for grain yield may be due to the influence of the environment on the yield as it is polygenic trait. Low heritability estimates might be due to the variation of environmental component involved for those traits and vice versa. High heritability estimated traits indicated a high response to selection for particular traits.

Estimated heritability is not very much useful because it includes the effect of both additive and non additive gene. The genetic advance with heritability is therefore a useful indicator to achieve expected result on the trait of interest of a population after selection. Further, genetic advance in percentage of mean give more precise result in comparison to only genetic advance. Genetic advance as percent mean was categorized as low (0-10%), moderate (10-20%) and high (≥20%). In the present study high genetic advance as percent of mean was estimated for grain yield. Days to tasseling, days to silking, plant height, ear height and ear length showed medium and remaining traits showed low genetic advance as percent of mean. In conformity to this findings, high genetic advance for grain yield and medium to low for other traits also reported by (Vasistha et al., 2013; Ogunniyan and Olakayo, 2014; Sharma et al., 2018). High to medium heritability coupled with medium to low genetic gain indicate observed characters among tested genotypes governed by non-additive gene action and thus heterosis breeding, family selection and progeny testing methods is used for improvement on such traits.

Table 3. Phenotypic (Vp) and genotypic variance (Vg), phenotypic coefficient (PCV) and genotypic coefficient of variance (GCV), heritability (broad sense), genetic advance (GA) and genetic advance as percent of mean (GAM) for observed traits

SN	Traits	Treatment	Error	Vg	Vp	Hbs	GCV	PCV	GA	GAM
1	DT	36.26	2.06	11.40	13.46	0.85	7.17	7.79	6.40	13.60
2	DS	34.65	2.33	10.77	13.11	0.82	6.59	7.27	5.28	10.60
3	TSI	0.57	0.50	0.02	0.53	0.04	5.52	26.85	0.05	2.01
4	PH	1830.05	148.96	560.36	709.32	0.79	9.69	10.90	37.35	15.29
5	EH	690.50	186.18	168.11	354.29	0.47	13.53	19.65	15.85	16.55
6	P/P	28.34	23.01	1.77	24.79	0.07	9.22	34.46	0.63	4.38
7	E/P	17.31	13.28	1.34	14.62	0.09	7.41	24.45	0.62	3.98
10	EL	5.15	0.62	1.51	2.13	0.71	8.76	10.42	1.83	13.08
11	ED	0.17	0.02	0.05	0.07	0.66	4.92	6.08	0.31	7.08
12	HC	0.45	0.25	0.06	0.32	0.20	10.23	22.85	0.20	8.13
15	GY	2123268	724770	466166	1190936	0.39	21.96	35.10	758.22	24.39

DT= Days to tasseling, DS= Days to silking, TSI= Tasseling silking interval, PH= Plant height (cm), EH=Ear height (cm), P/P= Number of harvested plants/plot, E/P= Number of harvested ears/plot, EL= Ear length (cm), ED= Ear diameter (cm), HC= Husk cover rating in 1-5 scale, GY= Grain Yield kg/ha, Vg=genotypic variance, Vp=phenotypic variance, Hbs= Heritability broad sense, GCV= Genotypic coefficient of variation, PCV= Phenotypic coefficient of variation, GA= Genetic advance, GAM= Genetic advance as percent of mean.

Correlation study

Days to tasseling and silking sowed significant positive correlation. These traits both showed significant positive association plant height, ear length and ear diameter indicated that plant height, ear length and ear diameter can be simultaneously increase while selecting relatively late plants. In line with this findings (Ogunniyan and Olakaago, 2014; Bhusal et al., 2017) reported significant positive correlation between days to tasseling, silking and plant height. Further, in conformity to present study (Pahadi and Sapkota, 2016; Khan et al., 2018) also reported significant positive correlation for days to silking with ear length and diameter, however Khan et al. (2018) reported non-significant positive relationship between days to tasseling with ear length and diameter. Similarly, significant positive relationship with days to siliking and non significant positive with days to tasseling towards ear length and ear diamenter was also reported by Sharma et al. (2018). Further plant height have shown significant positive correlation with ear height indicated that ear height can be altered simultaneously while selecting plants on the basis of height. In addition, plant height has shown significant positive association with number of ear harvested showed that ear prolificacy is higher in tall plants. Very similar findings on relationship between plant height, ear height and number of harvested plants were also reoprted by (Ogunniyan and Olakaago, 2014; Bhusal et al., 2017; Sharma et al., 2018). Harvested plants/plot showed significant association with harvested ear/plot. Likewise number of harvested ear showed significant positive association with ear length and ear diameter. Significant positive relation was also observed between ear length and ear diameter. These findings were also partially supported by (Pahadi and Sapkota, 2016; Bhusal et al., 2017; Sharma et al., 2018).

In the present study non significant positive correlation observed between plant height and ear length (r=0.304), plant height and ear diameter (r=0.285), plant height and number of plants/plot (r=0.267). Similarly ear height showed non significant positive correlation with plants/plot (r=0.227) and husk cover rating (r=0.22). Further both silking and tasseling days shown non significant positive association with husk cover rating and number of ears/plot. Number of harvested pods/plant showed non significant positive correlation with ear length (r=0.285) and ear diameter (r=0.304). On the other side, non significant negative correlation observed between husk cover and ear diameter, husk cover and number of harvested ear/plot, husk cover and number of harvest plants/plot and both days to tasseling and silking with harvested plants/plot.

Table 4. Phenotypic correlation coefficient of grain yield and yield attributing traits on early maize genotypes.

Traits	DT	DS	PH	EH	P/P	E/P	HC	EL	ED
DT	1								
DS	0.981**	1							
PH	0.355*	0.351*	1						
EH	0.162	0.165	0.733**	1					
P/P	-0.078	-0.038	0.267	0.227	1				
E/P	0.282	0.257	0.378*	0.146	0.587**	1			
HC	0.225	0.219	0.018	0.220	-0.108	-0.147	1		
EL	0.701**	0.718**	0.304	0.071	0.285	0.360*	0.108	1	
ED	0.467**	0.492**	0.285	0.037	0.304	0.316*	-0.150	0.684**	1
GY	0.300	0.274	0.498**	0.158	0.412**	0.762**	-0.264	0.472**	0.470**

** and ** significant at P=0.05 and P= 0.01 level of significance respectively.*

DT= Days to tasseling, DS= Days to silking, TSI= Tasseling silking interval, PH= Plant height (cm), EH=Ear height (cm), P/P= Number of harvested plants/plot, E/P= Number of harvested ears/plot, EL= Ear length (cm), ED= Ear diameter (cm), HC= Husk cover rating in 1-5 scale, GY= Grain Yield kg/ha

Grain yield had shown significant positive association for plant height, number of harvested plants/plot, number of harvested ears/plot, ear length and ear diameter indicated that selection in favour of these traits will improve grain yield on early maturing maize genotypes. These findings were in conformity with previous reporting by (Bhusal et al., 2017; Ogunniyan and Olakaago, 2014; Khan et al., 2018; Sharma et al., 2018). In addition non significant correlation was observed for days to tasseling ($r_=0.3$), days to silking ($r_=0.274$), ear height ($r_=0.158$) and husk cover rating ($r_=-0.264$)with grain yield.

Conclusions

This study identified maize genotypes SO3TEY-PO-BM, COMPOL-NIOBP and ACROSS-99402 suitable for rainfed bariland farming based on the maturity and yield performance. Dipal local was found extra early, thus it could be one of the parents for maize breeding program for developing early maturing maize varieties. This study indicated the genetic variability on the studied genotypes mostly inherited by non additive gene action and direct selection is not fruitful, so hybridization followed by selection is recommended for improvement. As plant height, number of harvested pods/plot, number of harvested ears/plot, ear length and ear diameter were found significantly positively correlated with maize grain yield thus selection applied in favour these traits will simultaneously improve maze yield of selected plants.

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