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Correlation analysis in S_1 lines of local maize (*Zea mays*. L) germplasms for grain yield and its attributes

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Abstract
The present investigation was carried out to study the relationship between grain yield and its components in thirteen maize genotypes comprising of ten S_1 lines derived from local maize germplasm and three hybrid varieties. Yield is a complex quantitative trait which is highly influenced by environmental factors. Plant selection for yield is therefore difficult. There are certain other traits in maize which are relatively highly heritable and less affected by environment. Identification and association of such traits through studies on genetic correlation helps the breeders to exercise indirect plant selection for grain yield. The experiment consisted of two trials with the same set of genotypes in two different nitrogen levels, *viz*., 80 kg N ha^{-1} and 0 kg N ha^{-1}. At N_0 level, grain yield had significant correlation with plant height, ear height, ear length, kernel rows per ear, kernels per row, 100 kernel weight, days to 50% pollen-shed and days to 50% silk at genotypic level. At N_{80} level, grain yield showed positive and significant correlation with plant height, ear height, ear length, ear diameter, kernels per row, 100 kernel weight and days to 75% dry husk at genotypic level.

Keywords: S_1 lines, maize, correlation, local germplasms, yield

Introduction
Maize (*Zea mays* L.) is the third most important major cereal crop in the world after rice and wheat. North East India is a harbour of local maize germplasm. Favourable alleles for various traits are dispersed in local germplasm. It is necessary to know the nature and magnitude of genetic variation in a set of local germplasm under study. Methodology for genetic improvement of plants differ depending upon mode of pollination, nature of traits whether qualitative or quantitative and other factors. Therefore, genetic variation and its various parameters are necessary to take an appropriate decision in plant breeding strategies. Yield is a complex quantitative trait which is highly influenced by environmental factors. Plant selection for yield is therefore difficult. There are certain other traits in maize which are relatively highly heritable and less affected by environment. Identification and association of such traits through studies on genetic correlation helps the breeders to exercise indirect plant selection for grain yield. Considering the points mentioned above, an investigation was undertaken. The results on phenotypic and genotypic correlation of traits are reported and discussed in the present paper.

Materials and methods
The experiment was carried out during *rabi*, 2015-16 for selfing in various local maize germplasm. The S_1 lines obtained from one generation of selfing were stored carefully for the next *rabi* season. The experimental site was prepared during *Kharif*, 2016 and a maize hybrid was grown in that site for reducing the variability in the soil heterogeneity resulting primarily from residual as well as inherent nutrient of the soil. The experimental site is located at Instructional-cum-Research (ICR) Farm of Assam Agricultural University, Jorhat at 26°46′ N latitude, 94°13′ E longitude and 86.6 m above the mean sea level (MSL). The climate of the area is sub-tropical humid. All the ten S_1 lines along with three hybrid varieties were planted for evaluation in randomized block design (RBD) with two replications under two different levels of applied nitrogen i.e. N_{80} (80 kg N ha^{-1}) and N_0 (0 kg N ha^{-1}) during *rabi*, 2016-17. The amount of P_2O_5 and K_2O fertilizers and other recommended practices used (excluding organic manures) were the same in both the levels of nitrogen.

Experimental material
Local maize germplasms were collected from different areas of North East India. Ten S_1 lines derived from ten local maize germplasm were used in the present study.

Three hybrids namely, P-3399, P-3522 and KMH25K45 were also included (Table 1). The entries from Sl. No. 1 to Sl. No. 10 were different S_1 lines derived from different maize germplasm.

Table 1: List of S_1 lines and hybrids used in the evaluation.

Sl. No.	Name of the entries	Entry code	Place /source
	S_1 entries:		
1	Mimban -1	MIZ-1	Mizoram
2	Medziphema Collection-2	NAG-4	Nagaland
3	Mizoram collection-1	MIZ-2	Mizoram
4	Manipur local	MAN-8	Manipur
5	Yerto	AR-1	Arunachal Pradesh
6	Mimban-2	MIZ-7	Mizoram
7	Imphal collection	MAN-4	Manipur
8	Mimpui	MIZ-3	Mizoram
9	Meghalaya-11	MEG-11	Meghalaya
10	TR-1	TR-I	Tripura
	Hybrids entries :		
11	P-3399	P-3399	M/S Pioneer Seeds Pvt. Ltd.
12	P-3522	P-3522	M/S Pioneer Seeds Pvt. Ltd.
13	KMH25K45	KMH25K45 (Kavery Bumper)	M/S Aditya B Enterprise

Results and discussion

Yield is the foremost consideration in the breeding of any crop. Studies on correlation coefficients of different plant characters are useful criteria to identify desirable traits that contribute to improve the dependent variable. Correlation coefficient is one of the important biometrical tools for formulating a selection index as it reveals the strength of relationship among the group of characters. This also helps to decide the dependability of the characters that have little or no importance. The relationship of a character with yield and other component characters could also be useful for the proper choice of parents for hybridization programme. Since the yield depends upon many yield contributing characters, it becomes essential to study the association of each character to the yield.

In the present investigation, at N_0 level (Table 2), both phenotypic and genotypic correlation coefficient revealed positive and significant correlation of grain yield with plant height, ear height, kernels per row and ear length. Genotypic correlation of traits might have resulted due to pleiotropy or linkage or both. Significant and positive correlation was found between grain yield and the other traits *viz.*, kernel rows per ear, 100 kernel weight, days to 50% pollen-shed and days to 50% silk at genotypic level only. Ear diameter had positive and highly significant correlation with kernel rows per ear at both genotypic and phenotypic levels. It was supported by Jayakumar *et al.* (2007) [2], Reddy *et al.* (2013) [6], Dar *et al.* (2015) [1] and Kumar *et al.* (2015) [4].

In the present investigation, association studies revealed that both phenotypic and genotypic correlation coefficients of grain yield with plant height, ear height, ear length, kernels per row and 100 kernel weight were positive and highly significant at N_{80} level (Table 3). Similar result was found by Jayakumar *et al.* (2007) [2]. Grain yield had positive and significant correlation with ear diameter and days to 75% dry husk only at genotypic level. It was supported by Joseph *et al.* (2015) [3] and Reddy *et al.* (2016) [5]. Yousuf *et al.* (2001) [7] found that grain yield per plant showed significant genotypic correlation with plant height and kernels per row. At N_{80} level, positive genetic correlation of yield with plant height, ear height, ear length, kernels per row, ear diameter, days to 75% dry husk and 100 kernel weight might have resulted due to pleiotropy or linkage or both. Selection may be exerted on secondary traits that have greater heritability than primary traits. Present study indicated that selection for genotypically correlated component traits *viz.*, plant height, ear height, ear length, kernels per row, ear diameter, days to 75% dry husk and 100 kernel weight might result in positive correlated response in yield.

The S_1 entry namely, MAN-8, had desirable (higher) mean for the traits *viz.*, grain yield, plant height, ear height, ear length, kernel rows per ear and 100 kernel weight at both N_0 and N_{80} levels the former one (grain yield) being positively correlated with the rest. Another S_1 entry MEG-11 had higher estimates for the traits *viz.*, grain yield, plant height and ear height at both levels of nitrogen the traits being positively correlated among them. At both nitrogen levels, the hybrid P-3399 had higher estimates for the traits *viz.*, grain yield, plant height, ear height, ear length and 100 kernel weight grain yield being positively correlated with the rest.

Table 2: Genotypic (above diagonal) and phenotypic (below diagonal) correlation coefficients among yield and its attributes at N_0 level.

	PH	EH	EL	ED	R/ E	K/ R	100KW	D50PS	D50S	ASI	D75DH	GY
PH		0.8150**	0.8432**	0.6068*	0.7248**	0.8269**	0.4361	0.3811	0.3709	0.2004	0.1857	0.9890**
EH	0.7660 **		0.8481**	0.4502	0.7510**	0.8352**	0.5489*	0.5765*	0.5626*	0.2526	0.4374	0.8226**
EL	0.7625 **	0.6933**		0.5254*	0.8134**	0.9399**	0.6509*	0.7755**	0.7439**	-0.2111	0.5583*	0.9857**
ED	0.4349	0.3672	0.3942		0.7148**	0.8119**	0.6922**	0.3206	0.3062	-0.0203	0.0657	0.4038
R/E	0.6273 *	0.6122 *	0.5672 *	0.6833 **		0.8650**	0.8186**	0.4809	0.4668	0.3023	0.3954	0.6927*
K/R	0.6335 *	0.5718 *	0.6830 **	0.3444	0.5962 *		0.6388*	0.5718*	0.5618*	0.0171	0.4902	0.6877**
100KW	0.4314	0.5205 *	0.6153 *	0.5706 **	0.6523 *	0.5063 *		0.6668*	0.6485*	0.3204	0.3971	0.6115*
D50PS	0.3718	0.5424 *	0.7023 **	0.2300	0.4286	0.4177	0.6526 *		0.9997**	-0.0933	0.9187**	0.6092*
D50S	0.3671	0.5220 *	0.6965 **	0.2267	0.4057	0.3924	0.6379 *	0.9972 **		-0.0365	0.9128**	0.6001*
ASI	0.1030	0.0471	-0.0012	0.0609	0.1298	-0.0443	0.2245	-0.0808	-0.0067		-0.3625	0.4842
D75DH	0.1672	0.3683	0.5463 *	0.0886	0.2852	0.2659	0.3757	0.8668 **	0.8723 **	-0.1392		0.3688
GY	0.8287 **	0.7777 **	0.6918 **	0.2498	0.5059	0.5455 *	0.4805	0.4887	0.4865	0.1762	0.3302	

Table 3: Genotypic (above diagonal) and phenotypic (below diagonal) correlation coefficients among yield and its attributes at N_{80} level

	PH	EH	EL	ED	R/ E	K/ R	100KW	D50PS	D50S	ASI	D75DH	GY
PH		0.7991**	0.8658**	0.4552	0.1384	0.9888**	0.9155**	0.3825	0.3449	-0.3759	0.4823	0.8986**
EH	0.7273 **		0.8822**	0.2969	0.0332	0.8342**	0.8428**	0.2641	0.2202	-0.5371	0.4206	0.8269**
EL	0.7375 **	0.7818 **		0.4844	0.1303	0.9414**	0.9398**	0.5879*	0.5506	-0.3028	0.6708*	0.8471**
ED	0.4114	0.2622	0.4941		0.7926**	0.5008	0.4181	0.3965	0.3986	0.2213	0.4159	0.5708*
R/E	0.1472	0.0027	0.1595	0.7500 **		0.1432	0.0541	0.3767	0.3961	0.4628	0.3774	0.2670
K/R	0.9195 **	0.7167 **	0.8253 **	0.4727	0.1930		0.9647**	0.6014*	0.5613*	-0.2944	0.6824*	0.9077**
100KW	0.8567 **	0.7690 **	0.8702 **	0.3777	0.0060	0.8855 **		0.5274	0.4853	-0.3627	0.6412*	0.9105**
D50PS	0.3642	0.2421	0.5610 *	0.3916	0.3266	0.5686 *	0.5192		0.9982**	0.4007	0.9740**	0.5467
D50S	0.3255	0.2041	0.5280	0.3980	0.3491	0.5357	0.4761	0.9970 **		0.4533	0.9665**	0.5086
ASI	-0.3177	-0.3753	-0.2161	0.2243	0.3919	-0.1981	-0.3171	0.3054	0.3761		0.3176	-0.3367
D75DH	0.4540	0.3991	0.6102 *	0.3729	0.2857	0.6156 *	0.6204 *	0.9593 **	0.9502 **	0.2183		0.6762*
GY	0.7880 **	0.6897 *	0.7837 **	0.5228	0.2334	0.8008 **	0.8292 **	0.4875	0.4584	-0.1945	0.5758 *	

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