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Correlation Analysis among 290 Inbred Lines of Maize (*Zea mays* L.)

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A B S T R A C T

Maize (*Zea mays* L.) is the third most important cereal in India after rice and wheat. It is grown in 178 million hectares globally in about 160 countries and contributes to 50% of global grain production (1,170 million MT). Area under maize is consistently, showing increasing trend as there is high demand for maize as it is used as input for large number of products. This demand needs to be met out from shrinking land resources and other production constraints. Yield is a complex inherited character and therefore, direct selection for yield *per se* may not be the most efficient method for its improvement. Indirect selection for other yield related characters with high correlation will be more effective. Correlation studies between yield and yield components are pre-requisite to plan a meaningful breeding programme to develop high yielding inbreds and hybrids. With this background, investigation was conducted to study the coefficient of correlation among 290 maize inbred lines. 290 inbred lines were raised in augmented design with 10 blocks including three checks in each block. Seeds were sown in a row length of 3m with 0.6m distance between rows and 0.3m distance between plants. Analysis of variance revealed significant difference between the inbred lines indicating the presence of diversity among inbred lines. Grain yield plant^{-1}, being the most important trait was found positively and highly correlated with kernels row^{-1} (0.816), cob diameter (0.813), cob length (0.811) and 100 seed weight (0.706). These traits exhibiting highly significant correlation suggests that, selection for these traits in a breeding program will help in enhancing the grain yield plant^{-1}*per se*.

Introduction

Maize (*Zea mays* L.) is the third most important cereal in India after rice and wheat (Centre for Monitoring Indian Economy, 2017).It is cultivated from 58°N to 40°S, from below sea to altitudes higher than 3000 m; in areas with 250 mm to more than 5000 mm of rainfall (Downswell *et al.,* 1995) indicating its wider adaptability. It is grown in 178 million hectares globally in about 160 countries and contributes to 50% of global grain production (1,170 million MT).

In India, maize constitutes 9% of the total volume of cereals produced with 23 m MT production and is the third most important food grain after rice (42%) and wheat (38%) with a productivity of 2.5 t ha^{-1} (Anon, 2015). Karnataka stands at 7th position in India in

maize production with an area of 1.18 m ha in 2015-16, producing 3.27 m t with a productivity of 2773 kg ha^{-1} (Anon, 2017). Maize provides food, feed, fodder, fuel and serve as a source of basic raw material for a number of industrial products *viz*., starch, oil, protein, alcoholic beverages, food sweeteners, cosmetics and bio-fuel etc.

Yield is a complex inherited character and therefore, direct selection for yield *per se* may not be the most efficient method for its improvement. Indirect selection for other yield related characters with high correlation will be more effective. Hence, correlation studies between yield and yield components are pre-requisite to plan a meaningful breeding programme to develop high yielding inbreds and hybrids.

Materials and Methods

Experiment was conducted at Zonal Agricultural Research Station, Mandyato study the correlation. 290 inbred lines including three checks *viz.,* SKV-50, MAI-105 and MAI-137 collected from CIMMYT, Zonal Agriculture Research Station, Mandya and University of Agricultural Sciences, Bengaluru constituted the experimental material for this experiment.

290 inbred lines were raised in augmented design with 10 blocks including three checks in each block. Seeds were sown in a row length of 3m with 0.6m distance between rows and 0.3m distance between plants. All the recommended crop production and crop protection practices were followed to raise a healthy crop.

Nitrogen was applied in two split doses; 60 kg at the time of sowing and 60 kg at knee height stage followed by intercultural operations. Preventive and curative sprays were given as and when required to ensure pest and disease-free crop. Observations on yield attributing characters *viz*., days to 50% silking, days to 50% tasseling, anthesis-silking interval, plant height, cob length, cob diameter, kernel rows cob^{-1}, kernerls row^{-1}, grain yield plant^{-1}, 100 seed weight and cob shelling *per cent*were recorded on five randomly selected plants of each inbred line based on counting/measurement using appropriate scale depending on the traits.

Results and Discussion

Analysis of variance revealed significant difference between the inbred lines indicating the presence of diversity among inbred lines (Table 1). Significant difference in analysis of variance suggests for further analyses to unravel the correlation among different characters.

Correlation study helps to reveal the direction and magnitude of relationship among the different traits. This facilitates in understanding the influence of one trait on the other. In any plant breeding program grain yield is given prime importance as it is the mandatory part of any improved cultivar. Hence, correlation of traits with the grain yield is more important that other combinations of correlation among traits.

In this study, grain yield plant^{-1}showed significant and positive correlation with all the traitsexcept days to silking (-0.328), days to tassel (-0.264) and anthesis-silking interval (-0.230) which showed significant and negative correlation with grain yield plant^{-1}(Ojo *et al*., 2006; Nataraj *et al*., 2014; Ram Reddy *et al*., 2013).

Highly significant correlation with grain yield plant^{-1} was observed for kernels row^{-1} (0.816), cob diameter (0.813), cob length (0.811) and 100 seed weight (0.706) (Wannows *et al*., 2010; Pavan *et al*., 2011; Kumar *et al*., 2006).

Table.1 Analysis of Variance for 290 inbred lines for yield and its component traits

Source of Variation	Degrees of freedom	DAS	DAT	ASI	PH	CL	CD	KRC	KR	GYP	100SW	CS%
Block (Ignoring treatments)	9	14.14***	9.97**	2.83**	2195.52***	14.2***	0.56	3.11***	88.87***	2098.87***	49.26***	59.92***
Inbred lines + Checks (Ignoring blocks)	292	18.41***	17.80***	2.66***	642.15***	6.61**	2.39*	3.73***	43.69***	1802.89***	34.97***	33.83***
Inbred lines	289	18.36***	17.24***	2.59***	641.17***	6.54**	2.18	3.20***	41.20***	1734.72***	34.01***	33.35***
Checks	2	25.43***	63.70***	6.70**	343.63	10.46*	12.43***	74.36***	257.30***	7983.58***	39.69*	99.21***
Checks *vs.* Inbred line	1	20.93**	89.01***	16.68***	1522.66**	21.80**	41.62***	15.10***	336.39***	9143.02***	304.74***	44.01*
Error	18	1.62	2.14	0.66	124.71	1.92	1.13	0.35	1.26	114.37	7.66	8.43

DAS- days to silking; DAT – days to tassel; ASI – anthesis-silking interval; PH – plant height; CL – cob length; CD – cob diameter; KRC – kernel rows cob[-1];
KR – kernels row[-1]; 100SW – seed weight; CS% - cob shelling %; GYP – Grain yield plant[-1]

Table.2 Estimates of correlation co-efficient at phenotypic level

	DAS	DAT	ASI	PH	CL	CD	KRC	KR	100SW	CS%	GYP
DAS	1	0.915***	0.258***	-.0059	-0.265***	-0.247***	-0.051	-0.316***	-0.208***	-0.065	-0.328***
DAT		1	-0.124*	-0.001	-0.223***	-0.184**	-0.021	-0.253***	-0.142*	-0.033	-0.264***
ASI			1	-0.140*	-0.168**	-0.223***	-0.115*	-0.223***	-0.179**	-0.113	-0.230***
PH				1	0.426***	0.382***	0.204***	0.394***	0.354***	0.170**	0.452***
CL					1	0.634***	0.227***	0.818***	0.579***	0.208***	0.811***
CD						1	0.532***	0.602***	0.654***	0.318***	0.813***
KRC							1	0.234***	0.020	0.155**	0.359***
KR								1	0.414***	0.397***	0.816***
100SW									1	0.294***	0.706***
CS%										1	0.441***

DAS- days to silking; DAT – days to tassel; ASI – anthesis-silking interval; PH – plant height; CL – cob length; CD – cob diameter; KRC – kernel rows cob^{-1}; KR – kernels row^{-1}; 100SW – seed weight; CS% - cob shelling %; GYP – Grain yield plant^{-1}

These traits exhibiting highly significant correlation suggests that, selection for these traits in a breeding program will help in enhancing the grain yield plant[-1]*per se*. Traits exhibiting significant and negative correlation suggests the negative selection for those traits (days to silking, days to tassel and anthesis-silking interval) to improve the grain yield plant[-1].

The component traits studied for the set of 290 inbred lines of maize showed significant correlation with the grain yield plant[-1] and among themselves indicating the presence of inter-relationship. Traits showing highly significant and significant correlation with the grain yield plant[-1] can be used as surrogate trait in selection for high yield.

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