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Correlation and path coefficient analysis among inbred lines of maize (*Zea mays* L.)

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ABSTRACT
Maize is one of the most important crops after rice and wheat. Area under maize is consistenly 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. One of the important steps to increase the maize production is to delineate the correlations of productivity traits among germplasm. With this background, investigation was conducted to study the coefficient of correlation and path coefficient 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 train was found positively and highly correlated with cob (0.804), followed by cob length (0.781), kernel row^{-1} (0.776), 100 seed weight (0.695), plant height (0.496) and kernel rows cob^{-1}. The correlation co-efficient were further classified into components of direct and indirect effects through path co-efficient analysis which facilitates in more reliable selection. From the analysis it was found that kernels row^{-1}(0.383), 100 seed weight (0.304) showed high direct effect on grain yield plant^{-1}. Whereas, cob diameter (0.262) showed moderate direct effect. The component traits studied showed significant correlation with the grain yield plant^{-1} and among themselves indicating the inter-relationship.
Keywords: path coefficient analysis, inbred lines, maize (Zea mays L.)

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INTRODUCTION

Maize is one of the most important crops after rice and wheat. In India, 47% of maize is consumed by poultry, 20% directly as food, 14% as cattle feed, 12% in starch manufacture and 7% in food processing and brewery. Though direct consumption of maize is not remarkable, number of industrial products for which maize and its bi-products are used as inputs are large. Maize is also used in manufacturing of pharmaceutical products. This value addition for maize has led to increased demand for maize, which needs to be met out from shrinking land resources and other production constraints. Selection is a basic and important step in any crop improvement. Breeders make efforts to improve the magnitude of response to selection. Economic value of a plant depends almost always upon several characters and it is important to find correlation between two or more characters. Coefficient of correlation indicates the relationship between two variables; however, it is insufficient to provide information in case where the value of a variable is determined by many interacting variables. This requires path coefficient analysis to obtain precise information regarding association between traits.

MATERIAL AND METHODS

Experiment was conducted at experimental plot, Department Of Genetics and Plant Breeding, University of Agricultural Sciences, Bengaluru to study the correlation and path analysis. 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 , 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 (Table 1) 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 and path coefficients of different characters.

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

Source of Variation	Degrees of freeedom	DAS	DAT	ASI	PH	CL	CD	KRC	KR	GYP	100SW	CS%
Block (Ignoring treatments)	9	24.57***	16.46***	2.36***	680.07**	12.47***	1.45**	2.09	52.34***	1014.22***	30.99	36.1
Inbred lines + Checks (Ignoring blocks)	292	23.09***	19.67***	1.34***	685.64***	7.09**	2.30***	3.29	33.79***	1569.81***	30.62*	43.07**
Inbred lines	289	23.26***	19.83***	1.33***	683.65***	7.12**	2.17***	2.87	34.06***	1576.24***	30.11*	41.62**
Checks	2	9.62*	5.01	3.44	452.79	2.16	10.51***	48.08***	6.10*	1272.67***	74.43*	142.39**
Checks *vs.* Inbred line	1	0.13*	3.81*	1.23*	1724.98**	6.74**	24.38***	33.00***	10.12*	13.18	91.01*	264.15***
Error	18	1.94	2.01	0.21	139.16	2.19	0.34	1.76	1.44	71.54	14.79	15.31

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}; GYP – Grain yield plant^{-1}; 100SW – seed weight; CS% - cob shelling %.

Correlation co-efficient (Table 2)signifies the direction of the relationship between all the character combinations and hence guide the process of selection in plant breeding. Grain yield plant^{-1}, being the most important train was found positively and highly correlated with cob (0.804), followed by cob length (0.781), kernel row^{-1} (0.776), 100 seed weight (0.695), plant height (0.496) and kernel rows cob^{-1} [1, 2]. Whereas, days to silking (-0.309), days to tassel (-0.273) and anthesis-silking interval (-0.227) were

negatively and significantly correlated with grain yield plant^{-1}.Highest positive correlation was recorded between days to silking and days to tasseling (0.946), cob length and kernels row^{-1} (0.8421), cob diameter and 100 seed weight (0.627), cob length and cob diameter (0.594) indicating that these characters are highly dependent on each other. Further, significantly high (p=0.001) and positive correlation for days to silking with days to tassel and anthesis-silking interval, plant height with cob length, cob diameter, kernel row cob^{-1}, kernels row^{-1} and 100 seed weight, cob length with cob diameter, kernel row cob^{-1}, kernels row^{-1} and 100 seed weight, cob diameter with kernel row cob^{-1}, kernels row^{-1},100 seed weight and shelling *per cent*, kernel row cob^{-1} with kernels row^{-1} and shelling *per cent*, kernel row^{-1} with 100 seed weight and shelling *per cent*was recorded [5-7]. On the other hand, significantly high (p=0.001) and negative correlation for days to silking with cobdiameter, kernel row-1, 100 seed weight and shelling *per cent*, days to tasseling with cob diameter, 100 seed weight and shelling *per cent*was recorded [3, 4]. The correlation co-efficient were further classified into components of direct and indirect effects through path co-efficient analysis (Table 3) which facilitates in more reliable selection. From the analysis it was found that kernels row^{-1}(0.383), 100 seed weight (0.304) showed high direct effect on grain yield plant^{-1}. Whereas, cob diameter (0.262) showed moderate direct effect. This indicated that, indirect selection can be practiced for grain yield plant^{-1} through these component traits [8, 9]. Days to silking, days to tassel and anthesis-silking interval showed negative and low diect effect. Further, kernels row^{-1} (0.303) showed positive and high indirect effect. Hence, study revealed that, direct selection for the traits, kernels row^{-1} and 100 seed weight is effective.

CONCLUSION

The component traits studied showed significant correlation with the grain yield plant^{-1} and among themselves indicating the inter-relationship. From the path co-efficient analysis, kernels row^{-1} and 100 seed weight recorded high direct effect on grain yield plant^{-1} and cob diameter (0.262) showed moderate direct effect.

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

	DAS	DAT	ASI	PH	CL	CD	KRC	KR	100SW	CS%	GYP
DAS	**1**	0.946***	0.386***	0.001	-.091	-0.239***	-0.049	-0.196***	-0.282***	-0.233***	-0.309***
DAT		**1**	0.188**	0.061	-0.061	-0.209***	-0.012	-0.168**	-0.259***	-0.213***	-0.273***
ASI			**1**	-0.147*	-0.163**	-0.129*	-0.045	-0.174**	-0.132*	-0.139*	-0.227***
PH				**1**	0.495***	0.375***	0.220***	0.402***	0.386***	0.092	0.496***
CL					**1**	0.594***	0.342***	0.842***	0.523***	0.189**	0.781***
CD						**1**	0.509***	0.546***	0.628***	0.273***	0.804***
KRC							**1**	0.279***	0.042	0.199***	0.405***
KR								**1**	0.376***	0.255***	0.776***
100SW									**1**	0.174**	0.695***
CS%										**1**	0.369***

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 3: Direct and indirect effects of yield related characters on grain yield in 290 inbred lines

	DAS	DAT	ASI	PH	CL	CD	KRC	KR	100SW	CS%
DAS	**-0.101**	0.095	0.039	0.001	-0.009	-0.024	-0.005	-0.020	-0.028	-0.024
DAT	-0.133	**-0.141**	-0.026	-0.009	0.009	0.029	0.002	0.024	0.036	0.030
ASI	-0.025	-0.012	**-0.063**	0.009	0.010	0.008	0.003	0.011	0.008	0.009
PH	0.001	0.005	-0.011	**0.074**	0.037	0.028	0.016	0.030	0.029	0.007
CL	-0.005	-0.003	-0.008	0.025	**0.050**	0.030	0.017	0.042	0.026	0.009
CD	-0.063	-0.055	-0.034	0.098	0.156	**0.262**	0.134	0.143	0.165	0.072
KRC	-0.005	-0.001	-0.005	0.022	0.034	0.051	**0.100**	0.028	0.004	0.020
KR	-0.075	-0.065	-0.067	0.154	0.323	0.209	0.107	**0.383**	0.144	0.098
100SW	-0.083	-0.076	-0.039	0.113	0.153	0.184	0.012	0.111	**0.294**	0.051
CS%	-0.023	-0.021	-0.014	0.009	0.018	0.027	0.019	0.025	0.017	**0.098**

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}

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