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TRAIT BASED SELECTION FOR GENETIC IMPROVEMENT OF KERNEL YIELD IN MAIZE (*ZEA MAYS L.*)

Agricultural Science

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ABSTRACT

Correlation and path analysis carried in inbred lines clearly indicated that SPAD chlorophyll meter reading, ear length, ear girth, number of kernel rows per ear, number of kernels per row and 100 kernel weight had positive and significant associations with kernel yield and among themselves. SPAD chlorophyll meter reading, ear length, number of kernel rows per ear, number of kernels per row and 100 kernel weight showed higher and positive direct and indirect effects on kernel yield. Hence, simultaneous selection of these traits would help in bringing genetic improvement of kernel yield in maize. Ear girth and number of kernel rows per ear though had positive and significant association with kernel yield but showed negative direct and indirect effects through other yield components. Days to maturity, plant height and anthesis-silking interval had either negative or positive but non-significant associations with kernel yield and low direct or indirect effects. Hence, a genotype with higher SPAD chlorophyll meter readings, ear length, number of kernels per row and 100 kernel weight coupled with medium plant height, days to maturity, ear girth, number of kernels per ear and low anthesis-silking interval is desirable to realize higher yields in maize.

KEYWORDS

Maize, correlations, direct and indirect effects.

INTRODUCTION

Yield is a complex trait which is a product of multiplicative interactions of a number of its components (Grafius, 1959 and Kashiani *et al*. 2010). Hence, simultaneous selection based on multiple traits would increase the efficiency of breeding programmes. Correlation and path analysis indicates the degree of association of yield components withy yield through their direct and indirect effects. The present study was carried out involving inbred lines of maize to identify yield components and understand the magnitude of their contributions to kernel yield so as to make simultaneous selections based on yield contributing traits and improve the efficiency of breeding programme aimed at genetic improvement in kernel yield.

MATERIALAND METHODS

The experimental material comprising of 10 inbred lines of maize were studied at Agricultural Research Station, Perumallapalle during rabi, 2015-16 season Each inbred line was raised in a single row of five meters length. A spacing of 75 cm was adopted between plant to plant within the row. The design adopted was a randomized block design with three replications. All the recommended package of practices were followed in raising the healthy crop. Data were recorded on SPAD chlorophyll reading at 50 per cent anthesis with the help of SPAD 502-meter. Data were recorded on five randomly selected plants for plant height (cm), ear length (cm), ear girth (cm), number of kernel rows per ear, number of kernels per row, 100 kernel weight at harvest in each replication. Days to tasseling, days to silking, days to maturity and kernel yield were recorded on plot basis. The difference in days between tasseling and silking was taken as anthesis-silking interval. Mean data were used for correlation and path analysis adopting standard statistical procedure (Steel *et al* 1980 and Wright, 1921 and SAS Institute, 2007).

RESULTSAND DISCUSSION:

Phenotypic correlations of yield attributing components with kernel yield and among yield components and the direct and indirect effects of yield components on kernel yield were presented in Table 1 and Table 2, respectively.

The associations of SPAD chlorophyll meter reading (0.6704**), ear length (0.8412**), ear girth (0.7915**), number of kernel rows per ear (0.7265**), number of kernels per row (0.7484**) and 100 kernel weight (0.8521**) with kernel yield were positive and highly significant at phenotypic level. The positive association of SPAD chlorophyll meter reading with kernel yield might be due to increased production and transport of energy from photosynthesis. Similar results of positive and significant associations of SPAD chlorophyll meter reading (Ghimire and Timsina, 2015), ear length (Rafique *et al*. 2004, Ibitome, 2010, Ghimire and Timsina, 2015 and Munawar *et al*. 2013), ear girth (Ghimire and Timsina, 2015), number of kernel rows per ear (Ghimire and Timsina, 2015, Munawar *et al*. 2013, Praveen *et al*. 2014, Hodassi, 2016 and Varaprasad and Shivani, 2017), number of kernels per row (Ghimire and Timsina, 2015, Alvi *et al*., 2011, Munawar *et al*. 2013, Praveen *et al.* 2014, Hodassi, 2016 and Varaprasad and Shivani, 2017) and 100 kernel weight (Ajmal *et al*., 2000, Kumar, 2000, Ghimire and Timsina, 2015, Munawar *et al*. 2013; Praveen *et al.* 2014, Joao paul *et al*., 2014, Hodassi, 2016 and Varaprasad and Shivani, 2017) were also reported in maize. Anthesis-silking interval (-0.2021), days to maturity (-0.3730) and plant height (0.0108) showed non-significant but either negative or positive correlation with kernel yield. Ghimire and Timsina, 2015 have also reported similar results of negative associations of days to maturity with kernel yield. Low anthesis-silking interval is desirable in maize. The lesser the gap between tasselling and silking interval, greater will be the seed setting percent. Ibitome, (2010) for plant height and Venugopal *et al*., (2003) and Kumar *et al*.,(2000) for days to maturity and anthesis-silking interval have observed either significantly positive or significantly negative associations, respectively with kernel yield. The deviations in the present study results might be due to change in the experimental material or sample size adopted in the estimations of correlations (Table1).

Associations among yield attributing component traits revealed that anthesis-silking interval had significant negative correlation with plant height (-0.5420**) only. Days to maturity with SPAD chlorophyll meter reading (-0.4815**), ear length (-0.4313**), ear girth (-0.4566**), number of kernel rows per ear (-0.5499**), number of kernels per row (-0.3895**) and 100 kernel weight (-0.5456**) showed significantly negative associations revealing that an increase in the number of days to maturity would results in decrease in all other yield contributing traits. Plant height had either positive or negative but non-significant association with all other traits studied. Negative associations of plant height and days to flowering and days to maturity were reported by Troyer and Larkinz, 1985 in maize.

SPAD chlorophyll meter reading exhibited positive and significant associations with ear length (0.4837**), ear girth (0.5298**), number of kernel rows per ear (0.6082**), number of kernels per row (0.6013**) and 100 kernel weight (0.6817**) revealing that increase in SPAD chlorophyll meter reading would results in increased ear length, ear girth, number of kernel rows per ear, number of kernels per row and 100 kernel weight.

The associations of ear length with ear girth (0.7510**), number of kernel rows per ear (0.7842**), number of kernels per row (0.7825**) and 100 kernel weight (0.8868**) were positive and significant. Similarly, ear girth with number of kernel rows per ear (0.7583**), number of kernels per row (0.8198**) and 100 kernel weight (0.8224**) had positive and significant associations. Number of kernel rows per ear had positive and significant association with number of kernels per row (0.8718**) and 100 kernel weight (0.8492**), while

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number of kernels per row had positive and significant association with 100 kernel weight (0.8948**).

To understand the exact contribution of yield attributes to kernel yield, the genotypic correlations were partitioned into direct and indirect effects through path analysis and the results obtained were presented in Table 2.

Ear length (1.2307) followed by number of kernels per row (1.0313), 100 kernel weight (0.2225), days to maturity (0.1440) and SPAD chlorophyll meter reading (0.1262) showed positive and higher direct effects on kernel yield. The traits *viz.,* anthesis-silking interval 0.0544) and plant height (0.0563) exhibited low positive direct effects while ear girth (-0.5998) and number of kernels per ear (-0.8010) showed negative direct effects on kernel yield. Ear length followed by number of kernels per row and 100 kernel weight exerted higher positive indirect effects on kernel yield via SPAD chlorophyll meter reading, number of kernel rows per ear, number of kernels per row and 100 kernel weight on kernel yield. Higher and positive direct effects of ear length, number of kernels per row and test weight were reported in maize by Munawar *et al* (2013); Praveen *et al* (2014) and Varaprasad and Shivani (2017). The traits *viz*., anthesis-silking interval, days to maturity and plant height showed either negative or positive but low indirect effects on kernel yield through all other traits studied. The traits, ear girth and number of kernels per ear though had positive and significant association with kernel yield but exhibited positive indirect effects through all other important yield contributing traits except with SPAD chlorophyll meter reading and ear length. Negative indirect effects of plant height and days to maturity on grain yield through most of the yield related traits as recorded in the present study were also reported by Munawar *et al*. (2013) and Varaprasad and Shivani (2017) in maize.

CONCLUSIONS

The present study indicated that SPAD chlorophyll meter reading, ear length, number of kernels per row and 100 kernel weight should be considered while formulating selection indices as these traits had strong positive and significant association with kernel yield and also among themselves besides exerting higher and positive direct and indirect effects on kernel yield. It is also evident from the study that a genotype with medium plant height, days to maturity, ear girth, more number of kernel rows per ear, low anthesis-silking interval coupled with higher SPAD chlorophyll meter readings, ear length, more number of kernels per row and 100 kernel weight would be desirable in realizing higher kernel yields in maize.

Table 1. Phenotypic Associations Of Yield Contributing Traits With Kernel Yield In Maize

	DM	PH	SPAD	EL	EG	NKRE	NKPR	KW	KY
ASI	0.0788	-0.5420**	-0.1327	-0.1240	-0.1283	-0.0188	-0.1070	-0.2482	-0.2021
DM		0.0966	-0.4815**	-0.4313**	-0.4566**	-0.5499**	-0.3895*	-0.5416**	-0.3730*
PH			0.1612	-0.0847	-0.2810	-0.1225	-0.1509	-0.0322	0.0108
SPAD				0.4837**	0.5298**	0.6082**	0.6013**	0.6817**	0.6704**
EL					0.7510**	0.7842**	0.7825**	0.8868**	0.8412**
EG						0.7583**	0.8198**	0.8224**	0.7915**
NKRE							0.8718**	0.8492**	0.7265**
NKPR								0.8948**	0.7484**
KW									0.8521**

*Significant @ 5% Level of probability; **Significant @ 1% Level of probability

Table 2. Direct And Indirect Effects Of Yield Contributing Traits On Kernel Yield In Maize

	ASI	DM	PH	SPAD	EL	EG	NKRE	NKPR	KW
ASI	0.0544	0.0283	-0.0976	-0.1116	-1.3835	0.3346	0.6258	-0.5144	-0.2097
DM		0.1440	0.0279	-0.1166	-0.9270	0.5509	0.5763	-0.7103	-0.1967
PH			0.0563	0.0117	-0.1191	0.1736	0.1509	-0.1980	-0.0184
SPAD				0.1262	1.1447	-0.4846	-0.7782	0.8057	0.1953
EL					1.2307	-0.5665	-0.7814	0.9801	0.2273
EG						-0.5958	-0.8525	1.0536	0.2183
NKRE							-0.8010	1.0597	0.2179
NKPR								1.0313	0.2050
KW									0.2225

ASI: Anthesis-silking interval; DM: Days to maturity; PH: Plant height (cm); SPAD: SPAD chlorophyll meter reading; EL: Ear length (cm); EG: Ear girth (cm); NKRE: Number of kernel rows per ear; NKPR: Number of kernels per row; KW: 100 kernel weight (g); KY: Kernel yield (g)

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