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**Research Note**

# Variability studies of quantitative characters in Maize (*Zea mays* L.)

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**Abstract**
One hundred and forty four maize inbreds were evaluated for 15 different quantitative characters. Analysis of variance and the phentotypic range showed the availability of considerable variation for all the characters studied. The difference between PCV and GCV was very low for all the characters except Anthesis - Silking interval, cob yield/plant and grain yield/plant which showed that there was very little environmental effect on these characters. Anthesis-silking interval recorded high PCV, GCV, heritability and genetic advance as per cent of mean. Characters such as grain yield/plant, cob yield/plant and ear height showed comparatively moderate PCV and GCV values, moderate to high heritability with moderate genetic gain. This shows the presence of considerable variation among the inbreds for these traits and the possibilities of improvement in these characters through selection. Days to 50% tasseling, days to 50% silking and number of leaves/plant showed low PCV, GCV and GA with very high heritability suggesting that there is very little scope for improving these characters by selection.
**Keywords**
Maize, variability, heritability, genetic advance

Maize (*Zea mays* L.) is the third most important cereal crop of the world after wheat and rice. It is cultivated in a wider range of environments than wheat and rice because of its greater adaptability. In India maize is cultivated in an area of 8.5 million hectares with an average productivity of 2.54 tonnes/ha. Single cross hybrids have the highest yield potential than other type of hybrids. Now research efforts have been focused on the development of high yielding single cross hybrids of different maturity, suitable for different agro-ecological regions of India (Parihar *et al*. 2011). Success of any single cross hybrid development program largely depends on the selection of elite parental inbreds. Selection of superior inbreds will be possible only when adequate variability exists in the gene pool. Hence, an attempt was made in the current study to estimate the genetic variability among the available inbreds with the aid of genetic parameters such as phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), broad sense heritability and genetic advance (GA) as per cent of mean.

One hundred and forty four inbred lines derived from different base populations formed the base material for the study. The experiment was conducted in a simple lattice design with two replications at FCS research farm, Attur, Tamilnadu. Each genotype was assigned to 4.8 $m^2$ plot with inter and intra row spacing of 60 cm and 25 cm respectively. Recommended cultural practices were followed to raise a healthy crop. The data was recorded on five randomly selected plants from each treatment on 15 distinct morphological characters *viz.* days to 50% tasseling, days to 50% silking, anthesis - silking interval, plant height (cm), ear height (cm), number of leaves/plant, ear length (cm), ear girth (cm), number of kernel rows, number of kernels/row, number of kernels/ear, 100 seed weight (g), shelling percentage, cob yield/plant (g) and grain yield/plant (g). The mean values were computed and used for statistical analysis. The statistical analysis was carried out using Windostat software package.

The results of analysis of variance and important genetic parameters are presented in Table 1. Analysis of variance showed highly significant differences among the genotypes for all the observed characters which indicated that there was considerable amount of genetic variability among the studied inbreds. The range also showed the wide phenotypic variation for all the characters except anthesis – silking interval and number of leaves/plant.

The magnitude of PCV was higher than the GCV for all the characters studied revealing that the apparent variation is not only due to the genotype but also due to the influence of environment. A marked difference between PCV and GCV was observed for anthesis – silking interval, cob yield/plant and grain yield/plant suggesting the role of GxE interactions on these characters. The difference between PCV and GCV was very low for all other characters indicating little effect of environment on their expression. High PCV and GCV values were recorded for anthesis – silking interval (43.04 and 39.71) followed by grain yield/plant (20.96 and 18.35), cob yield/plant (20.62 and 18.27) and ear height (20.38 and 19.56) which showed the availability of ample variation among the inbreds for these characters. However, days to 50% tasseling (4.19 and 4.13), days to 50%

silking (4.62 and 4.55) and shelling percentage (4.63 and 3.80) recorded very low PCV and GCV values suggesting the availability of limited variability among the inbreds. Thanga Hemavathy *et al*. (2008) have reported high PCV and GCV values for kernels/row followed by grain yield in their study utilizing 42 diverse maize inbreds.

The estimates of heritability in broad sense revealed that flowering traits namely days to 50% tasseling and days to 50% silking had the highest heritability of 97%. This was closely followed by plant height (95%) and ear height (92%). The higher estimates of heritability indicate that selection on the basis of phenotypic performance of genotypes would also be more efficient in further improvement of these traits (Jadhav *et al.* 2011). However, most of the yield contributing characters showed moderate heritability values. Shelling percentage recorded the lowest heritability value (67%) followed by grain yield/plant (77%), number of kernel rows (78%) and cob yield/plant (79%). Ojo *et al.*(2006) have reported lowest broad sense heritability estimate of 32.29% for days from planting to harvesting and highest value of 99.99% for ear weight with sheath and ear weight without sheath. Low to high heritability values were obtained by Idris and Abuali (2011) in their study on nine traits in different maize genotypes.

Highest estimate of genetic advance as percent of mean (75.47) was obtained for anthesis-silking interval followed by ear height (38.67), cob yield/plant (33.35) and grain yield/plant (33.12). This indicates that selection would be rewarding for further improvement of such traits. Similar findings were reported by Alake *et al.* (2008) who have recorded highest genetic advance as per cent of mean for kernel row per ear (39.49) followed by grain yield/hectare (33.98) and ear length (16.54). Shelling percentage had the lowest GA (% mean) of 6.42 followed by number of leaves/plant and days to 50% tasseling with 8.09 and 8.36 respectively.

It is well known that the GCV together with high heritability estimates would give a better picture of the extent of genetic gain to be expected under selection. Johnson *et al.* (1955) suggested that heritability considered together with GA is more reliable in predicting the effect of selection than heritability alone. In the current study, Anthesis – Silking interval has shown high GCV, heritability and GA values and selection for this character is expected to result in maximum genetic gain. Important yield contributing characters *viz.* cob yield/plant, grain yield/plant and number of kernels/ear registered moderate GCV, heritability and GA emphasizing the role of both additive and non additive gene action for these traits which in turn indicates that recurrent selection shall be utilized for improvement of these characters. Selection for days to 50% tasseling and days to 50% silking is not expected to result in maximum genetic gains since only the heritability value was high for these characters.

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**Table 1. Analysis of variance and variability estimates for 15 characters in 144 inbreds of maize**

| Character | Analysis of variance (Mean squares) | | | Range | Genetic parameters | | | |
|---|---|---|---|---|---|---|---|---|
| | Replication | Treatment (unadjusted) | Intra block error | | PCV (%) | GCV (%) | Heritability (Broad sense) | GA (% of mean) |
| Degrees of freedom | 1 | 143 | 121 | - | - | - | - | - |
| Days to 50% tasseling | 1.254 | 12.572* | 0.330 | 54.5 - 68.0 | 4.19 | 4.13 | 0.97 | 8.36 |
| Days to 50% silking | 0.587 | 16.170* | 0.497 | 61.6 - 70.0 | 4.62 | 4.55 | 0.97 | 9.22 |
| Anthesis - silking interval | 0.867 | 1.288* | 0.183 | 0.0 - 4.0 | 43.04 | 39.71 | 0.85 | 75.47 |
| Plant height (cm) | 94.761 | 906.980* | 39.772 | 95.9 - 191.2 | 15.53 | 15.10 | 0.95 | 30.25 |
| Ear height (cm) | 73.004 | 369.280* | 25.611 | 42.6 - 107.7 | 20.38 | 19.56 | 0.92 | 38.67 |
| Number of leaves/plant | 3.001 | 1.051* | 0.343 | 10.3 - 13.8 | 6.05 | 4.87 | 0.65 | 8.09 |
| Ear length (cm) | 6.154 | 7.121* | 0.684 | 9.9 - 21.2 | 12.71 | 12.06 | 0.90 | 23.58 |
| Ear girth (cm) | 4.500 | 1.679* | 0.219 | 10.9 - 16.2 | 6.76 | 6.28 | 0.86 | 12.01 |
| Number of kernel rows | 0.354 | 3.238* | 0.737 | 9.8 - 16.7 | 9.51 | 8.39 | 0.78 | 15.22 |
| Number of kernels / row | 3.943 | 22.657* | 3.130 | 15.0 - 32.7 | 13.83 | 12.84 | 0.86 | 24.54 |
| Number of kernels / ear | 140.140 | 5606.580* | 1185.640 | 198.1 - 448.7 | 16.27 | 14.43 | 0.78 | 26.37 |
| Hundred seed weight (g) | 2.136 | 35.789* | 4.414 | 19.8 - 41.3 | 14.43 | 13.53 | 0.88 | 26.12 |
| Shelling percentage | 58.590 | 29.622* | 9.570 | 63.4 - 80.6 | 4.63 | 3.80 | 0.67 | 6.42 |
| Cob yield (g) | 461.660 | 886.020* | 190.440 | 61.1 - 169.9 | 20.62 | 18.27 | 0.79 | 33.35 |
| Grain yield/plant (g) | 71.728 | 632.860* | 146.060 | 50.1 - 142.3 | 20.96 | 18.35 | 0.77 | 33.12 |

* - Significant at p=0.01 level