Available online at www.ijpab.com

ISSN: 2320 – 7051
Int. J. Pure App. Biosci. **2 (1):** 272-275 (2014)

Research Article

International Journal of Pure & Applied Bioscience

Genetic Variability, Heritability and Genetic Advance Studies in Newly Developed Maize Genotypes (*Zea mays* L.)

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ABSTRACT

The present study was conducted at Maize Research Centre, Agricultural Research Institute, Rajendranagar, Hyderabad during Rabi, 2012-13 to determine the various parameters of genetic variability, broad sense heritability and genetic advance estimates in newly developed 86 maize genotypes. Analysis of variance revealed that the mean sum of squares due to genotypes showed significant differences for all the 12 characters studied. Traits yield per plant, plant height, ear height, number of kernels per row, 100-kernel weight were showed high heritability accompanied with high to moderate genotypic and phenotypic coefficient of variation and genetic advance which indicates that most likely the heritability is due to additive gene effects and selection may be effective in early generations for these traits. Whereas high to moderate heritability along with low estimates of genetic advance were observed for days to 50 per cent tasseling, days to 50 per cent silking, shelling percentage, ear length and days to maturity ear girth and number of kernel rows per ear.

Key Words: *Maize, Heritability, Genetic Advance, Genotypic and Phenotypic coefficient of variation (PCV and GCV).*

INTRODUCTION

Maize is grown in a wide range of environments in India suggesting its wider adaptability. Globally, 67 percent of maize is used for live stock feed, 25 percent for human consumption and rest for industrial purposes. Among cereals, maize is rich in starch, proteins, oil and sucrose, due to which it has assumed significant industrial importance. Maize and its main by-products starch, syrup, glucose, gluten and oil are used in diversified industries like alcohol production, textile, paper, pharmaceuticals, cosmetic industry, edible oil industry, poultry feed and many chemical industries. Maize protein "Zien" has significant quantities of vitamin A, nicotinic acid, riboflavin, vitamin E and phosphorus. Maize oil obtained from germ of kernel is rich in polyunsaturated fatty acids and also contains high level of natural anti-oxidants; hence maize oil is ideal for heart patients.

Maize is a highly cross pollinated and C_4 type plant which is highly responsive to fertilizers resulting in high per day productivity. It offers tremendous scope for the plant breeders for genetic improvement. Genetic variability among individuals in population offers effective selection. The magnitude of genetic variability present in population is of paramount importance for the success of any plant breeding program. Heritability alone provides no indication of the amount of genetic improvement that would result from selection of individual genotypes. Hence knowledge about genetic advance coupled with heritability is most useful.

MATERIALS AND METHODS

The present experiment was carried out at Maize Research Centre, Agricultural Research Institute, Rajendranagar, Hyderabad during *Rabi*, 2012-13 in newly developed 86 maize genotypes. Each entry was sown in two rows of four meters length with a spacing of 75 cm between rows and 20 cm between the plants. The data on twelve quantitative characters namely, plant height, ear height, ear length, ear girth, number of kernel rows per ear, number of kernels per row, 100 kernel weight, shelling percentage and grain yield per plant were recorded on five randomly selected competitive plants in each replication, whereas days to 50 per cent tasseling, days to 50 per cent silking, days to maturity were recorded on plot basis. The mean values were used for statistical analysis. Analysis of variance was done for partitioning the total variation into variation due to treatments and replications according to procedure given by Panse and Sukhatme. Heritability in broad sense was calculated by the formula given by Burton and Devane. The estimates of genetic advance were obtained by the formula given by Johnson.

RESULTS AND DISCUSSION

Analysis of variance revealed significant differences for all the 12 quantitative traits studied which was presented in Table 1. Grain yield per plant (2029.43) showed highest genetic variability followed by plant height (1646.92), ear height (504.25), 100-kernel weight (37.18), number of kernels per row (36.17), days to 50 per cent silking (12.13) and days to 50 per cent tasseling (10.91). Low genetic variability was recorded for Shelling percentage (9.53), ear length (6.50), Days to maturity (5.96), ear girth (2.13) and number of kernel rows per ear (1.16). High estimates of genotypic variance and phenotypic variance were recorded for grain yield, plant height, ear height, 100-kernel weight and number of kernels per row thus indicating presence of sufficient inherent genetic variance over which selection can be effective. Similar results were reported by Rather[1], Jawaharlal[2], Anshuman[3] and Rajesh[4].

High to moderate PCV and GCV recorded for grain yield, ear height, 100-kernel weight, number of kernels per row, plant height, ear length and ear girth as presented in Table 2. Suggesting sufficient variability and offers scope for selection. Similar results of PCV and GCV values for grain yield and other traits were reported by Zahid Mahmood[5] and Abirami[6]. Heritablity was found to be highest for plant height (98.46) followed by grain yield (97.44), number of kernels per row (93.18), days to maturity (91.22), ear height (91.02), days to 50 per cent silking (90.91), ear length (90.51), 100-kernel weight (88.83), days to 50 per cent tasseling (88.35), ear girth (84.93), Shelling percentage (74.15) and number of kernel rows per ear (73.12) as presented in Table 2. High values of heritability in broad sense indicate characters is less influenced by environmental effects. Similar results were reported by Chen[7], Satyanarayan and Kumar[8] and Ojo[9].

Heritability and genetic advance are important selection parameters. Heritability estimates along with genetic advance are normally more helpful in predicting the gain under selection than heritability estimates alone. Hence knowledge about genetic advance coupled with heritability is most useful. Character exhibiting high heritability may not necessarily give high genetic advance. High heritability should be accompanied with high genetic advance to arrive more reliable conclusion. Expected genetic advance as per cent of mean indicates the mode of gene action in the expression of a trait, which helps in choosing an appropriate breeding method. High heritability with high estimates of genetic advance were observed for grain yield, plant height, ear height. High heritability with moderate estimates of genetic advance were observed for number of kernels per row and 100-kernel weight. High to moderate heritability along with low estimates of genetic advance were observed for days to 50 per cent tasseling, days to 50 per cent silking, shelling percentage, ear length, days to maturity, ear girth and number of kernel rows per ear were presented in Table 2.

High heritability accompanied with high to moderate GCV and Genetic advance in case of Yield per plant, plant height, ear height, number of kernels per row and 100-kernel weight indicates that most likely the heritability is due to additive gene effects and selection may be effective in early generations for these traits. Whereas number of kernel rows per ear, days to 50 per cent tasseling, days to 50 per cent silking, shelling percentage and days to maturity exhibited moderate to high heritability along with low GCV and days to 50 per cent tasseling, days to 50 per cent silking, shelling percentage, ear length, days to maturity, ear girth and number of kernel rows per ear exhibited moderate to high heritability along with low genetic advance indicating non-additive gene action and provides limited scope for improvement of traits through selection. Similar results were reported by Zahid Mahmood[5], Thanga Hemavathy[10], Jawaharlal[2] and Anshuman[3].

Table 1. Analysis of variance for yield and yield component characters in maize

Characters \ Source of varaition	Replication	Genotype	Error
d.f.	2	85	170
Days to 50 % tasseling	3.91	34.19**	1.44
Days to 50 % silking	3.22	37.63**	1.21
Days to maturity	0.51	18.47**	0.57
Plant height (cm)	25.18	4966.54**	25.75
Ear height (cm)	192.12*	1562.52**	49.75
Ear length (cm)	0.88	20.20**	0.68
Ear girth (cm)	0.65	6.79**	0.38
Number of kernel rows per ear	0.31	3.92**	0.42
Number of kernels per row	1.17	111.18**	2.64
100-kernel weight (g)	3.85	116.23**	4.67
Shelling percentage	0.86	31.93**	3.32
Grain yield per plant (g)	136.02	6141.53**	53.22

* Significant at 5 per cent level; ** Significant at 1 per cent level

Table 2. Estimation of genetic parameters for different quantitative characters in Maize

Characters	**σ^2 g**	**σ^2 p**	**Co-efficient of Variation**		**h^2 (%) (Broad Sense)**	**GA (%)**		**GA as Per cent mean**	
			GCV	**PCV**		**GA 5%**	**GA 1%**	**5%**	**1%**
Days to 50 % tasseling	10.91	12.35	4.44	4.73	88.35	6.39	8.19	8.61	11.03
Days to 50 % silking	12.13	13.35	4.50	4.72	90.91	6.84	8.77	8.85	11.34
Days to maturity	5.96	6.54	2.14	2.24	91.22	4.80	6.15	4.22	5.40
Plant height (cm)	1646.92	1672.68	17.44	17.58	98.46	82.95	106.30	35.66	45.70
Ear height (cm)	504.25	554.00	20.55	21.54	91.02	44.13	56.55	40.40	51.77
Ear length (cm)	6.50	7.19	14.35	15.09	90.51	5.00	6.40	28.13	36.06
Ear girth (cm)	2.13	2.51	10.03	10.89	84.93	2.77	3.55	19.05	24.42
Number of kernel rows per ear	1.16	1.59	7.64	8.94	73.12	1.90	2.43	13.46	17.25
Number of kernels per row	36.17	38.82	18.54	19.21	93.18	11.96	15.32	36.88	47.26
100-kernel weight (g)	37.18	41.86	19.41	20.60	88.83	11.83	15.17	37.70	48.31
Shelling percentage	9.53	12.86	3.90	4.53	74.15	5.47	7.02	6.92	8.87
Grain yield per plant (g)	2029.43	2082.66	33.33	33.77	97.44	91.60	117.40	67.79	86.87

CONCLUSION

In the present study high estimates of genotypic and phenotypic coefficient of variation were observed for grain yield per plant, ear height and traits 100 grain weight, number of kernels per row, plant height and ear length showed moderate estimates of genotypic and phenotypic coefficient of variation suggesting sufficient variability and thus offers scope for genetic improvement through selection. High heritability with high to moderate estimates of genetic advance recorded for Yield per plant, plant height, ear height, number of kernels per row, 100-kernel weight where careful selection may lead towards improvement for these traits. Hence, provides better opportunities for selecting plant material for these traits in maize.

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