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VARIABILITY STUDIES IN MAIZE GENOTYPES UNDER TEMPERATE CONDITIONS OF KASHMIR, INDIA

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Abstract

The present study was conducted at Dryland Agriculture Research Station, SKUAST-K, India during *Kharif* 2013. Variability, broad sense heritability and genetic advance was estimated in 80 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, temperate conditions, GCV, PCV, heritability, genetic advance.

Introduction

Maize (*Zea mays* L.) is one of the most important cereal crops globally after wheat and rice and holds a unique position in world agriculture as food, feed and source of diverse industrially important products. It is grown under wide range of climatic conditions, mostly in warmer parts of the temperate region and areas of humid sub-tropical climate.

Maize is one of the four principle crops of the world and occupies an important place in India due to its high potential and greater demand for food, feed and industrial utilization. Maize is the major crop of Jammu and Kashmir in terms of acreage under any crop. The average yield levels of this crop have also nearly doubled since last decade. This increase in yield has been mainly achieved by increase in the area under high yielding varieties and adaptation of recommended technologies developed by SKUAST-K. However, the genetic potential of the improved varieties is at least three times of the present average of the state. Maize is gown in the state during *Kharif* season and about 85% of the copped area is rainfed. In Jammu & Kashmir, maize is grown over an area of 315.8 thousand hectares with a production of 633.2 thousand tones and a productivity of 2.04 tones per hectare.

In the Kashmir province bulk of the maize area in confined to the districts of Kupwara, Baramulla, Budgam and Anantnag. Major constraints for maize cultivation primarily involves predominance of cultivated land races, non-availability of vital inputs, in accessibility, scattered and small land holding and cultivation of maize over a wide range of environmental conditions ranging from approximately 1650 m to above 2,600 m a.m.s.l, mostly under rainfed environments.

Materials and Methods

The present experiment was carried out at Dryland Agriculture Research Station, SKUAST-K during *Kharif* 2013 and involved eighty genotypes of maize. 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 in three replications. The data on ten quantitative characters namely, days to 50% tasseling, days to 50% silking, days to maturity, plant height, ear height, ear length, number of kernel rows per ear, number of kernels per row, 100 kernel weight and grain yield per plant was 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

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

Characters \ Source of varaition	Replication	Genotype	Error
d.f.	2	79	158
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
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
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 of 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
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
Grain yield per plant (g)	2029.43	2082.66	33.33	33.77	97.44	91.60	117.40	67.79	86.87

according to procedure given by Panse and Sukhatme (1967). Heritability in broad sense was calculated by the formula given by Burton and Devane (1953). The estimates of genetic advance were obtained by the formula given by Johnson *et al*. (1955).

Results and Discussion

Analysis of variance revealed significant differences for all the 10 quantitative traits studied (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 ear length (6.50), days to maturity (5.96) 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 *et al*. (2003), Jawaharlal *et al*. (2011), Anshuman *et al*. (2013) and Rajesh *et al*. (2013). 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 Abirami *et al*. (2005). Heritability 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), and number of kernel rows per ear (73.12) as presented in table 2. High values of heritability in broad sense indicate character is less influenced by environmental effects. 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, ear length, days to maturity, and number of kernel rows per ear (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 indicating 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 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 Hemavathy *et al.* (2008).

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.

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