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Genetic Studies for High Yield of Maize in Chitral Valley

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ABSTRACT

Sufficient genetic variability was recorded among five hybrids and five open pollinated varieties of maize. Genotypic and phenotypic correlations were ascertained for grain yield and its components. The results revealed that ear length showed positive and highly significant correlation with grain yield plant^{-1}, plant height, number of kernel rows ear-^{1}, days taken to tasseling, and days taken to silking. Grain weight showed positive correlation with grain yield plant^{-1}. These characters must be considered in selection for high grain yield.

Key Words: Genetics; Maize; Chitral; Pollination

INTRODUCTION

Maize is a multipurpose crop, used as food, feed, fodder and industrial raw material. Its worth as an industrial raw material is rapidly increasing and is extensively used for the preparation of corn starch, corn oil, dextrose, corn syrup, corn flacks, gluten, grain cakes, lactic acid, alcohol, acetone and certain other products. Maize due to its cropping period has attained top priority in the area of high mountains especially the northern parts of Pakistan, where chilling conditions and snowfall confines the growing period of other cereals.

In Pakistan, maize is sown on an area of 0.962 m ha with annual yield 1.67 m tons and average production 1730 kg ha^{-1} (Anonymous, 2000). Pakistan is lagging behind the world's average grain yield and the maximum potential is yet to be exploited. There is great scope for increasing maize production in the country with sole objective to achieve the level of self-sufficiency in food grains. District Chitral occupies an area of 14850 sq. kilometers with dry temperate valleys at an elevation ranging from 1400-2500 m above the sea level (Mulk, 1990). More than 90% of the population in Chitral is dependent on agriculture, while only 4% of the total land is cultivable. The access to other parts of country is through Lowary Pass, which remains closed due to snowfall for most of the times during the year (Zahur, 1993), so inaccessibility and small land holding in Chitral necessitate maximizing the productivity of cereal cultivars especially in maize. Grain yield is considered to have positive correlation with plant height, and 1000-grain weight (Ajmal *et al.,* 2000). Grain yield was significantly and positively associated with plant height, ear length and 100-grain weight (Rehman *et al.,* 1995). Coefficient of genotypic correlation was generally higher than phenotypic. Days to silking showed positive correlation with grain yield plant^{-1} (Afzal *et al.,* 1997).

Keeping in view the genetic studies on maize were undertaken in Chitral Valley to determine phenotypic and genotypic correlations of grain yield of Maize.

MATERIALS AND METHODS

The study was conducted in Shishi Lusht valley District Chitral, during summer 2001. Five maize hybrids viz. Babar, YHB 555, 3012, 3062, 3130 and five open pollinated varieties possessing a wide genetic background viz. EV 1097, EV 1098, EV 2097, EV 5098 and Sarhad Yellow were grown in randomized complete block design with three replications. Each plot consisted of three rows of three-meter length with row spacing and plant spacing of 60 and 30 cm, respectively. Data on number of days taken to tasseling, number of days taken to silking, plant height, ear length, number of kernel rows ear^{-1}, number of kernels row^{-1}, 100-grain weight and grain yield plant^{-1} were recorded from 15 randomly earmarked plants in each plot during the cropping season and after harvest.

Analysis of variance for all the plant traits recorded was carried out according to Steel and Torrie (1980). The genotypic and phenotypic correlation coefficients were calculated among plant traits by using the techniques given by Kwon and Torrie (1964).

RESULTS AND DISCUSSION

Analysis of variance was carried out to partition the variances into its components. The result of the analysis revealed highly significant differences among the mean values for all traits i.e. number of days taken to tasseling, number of days taken to silking, plant height, ear length, number of kernel rows ear^{-1}, number of kernels row^{-1}, 100-grain weight and grain yield plant^{-1} (Table I). The results of correlation analysis given in Table II revealed that correlation coefficients between grain yield plant^{-1} and other characters were positive on both genotypic and phenotypic levels. The ear length and number of kernels row^{-1} depicted highly significant positive correlation with grain yield plant^{-1}. Plant height had positive correlation with all the characters except100-grain weight. Number of days taken to tasseling, number of kernels row^{-1}, number of days taken to siliking and ear length were positively and significantly correlated with plant height, the "r_g" being 0.641, 0.726,

Table I. Analysis of variance for different plant traits in maize

Source of variation	Degree of freedom	No. of days taken to tasseling	No. of days taken to silking	Plant height	Ear length	No. of kernel rows ear^{-1}	No. of kernels row^{-1}	100-grain weight	Grain yield plant^{-1}
Varieties	9	57.200**	68.059**	1129.346**	12.309**	2.077**	65.426**	37.894**	1876.414**
Blocks	2	1.200	3.633	0.700	0.619	0.042	2.233	0.374	14.179
Error	18	1.756	1.337	5.737	0.665	0.098	2.604	2.897	4.564

** Significant at 1% probability level

Table II. Estimates of genotypic (r_g) and phenotypic (r_p) correlation coefficients among yield and yield related traits in maize

		No. of days taken to tasseling	No. of days taken to silking	Ear length	No. of kernel rows ear^{-1}	No. of kernels row^{-1}	100-grain weight	Grain yield plant^{-1}
Plant height	r_g	0.641*	0.767**	0.647*	0.172	0.726*	-0.148	0.479
	r_p	0.611	0.736*	0.583	0.148	0.682*	-0.125	0.474
No. of days taken to tasseling	r_g		0.969**	0.323	0.468	0.389	-0.630*	0.018
	r_p		0.906**	0.303	0.392	0.327	-0.581	0.018
No. of days taken to silking	r_g			0.551	0.488	0.620	-0.637*	0.206
	r_p			0.475	0.440	0.521	-0.580	0.203
Ear length	r_g				0.589	0.968**	0.142	0.936**
	r_p				0.491	0.888**	0.141	0.862**
No. of kernel rows ear^{-1}	r					0.403	-0.245	0.333
	r_p					0.344	-0.219	0.304
No. of kernels row^{-1}	r_g						0.029	0.861**
	r_p						0.089	0.806**
100-grain weight	r_g							0.538
	r_p							0.4568

* Significant at 0.01 probability level ** Highly significant at 0.05 probability level

0.767 and 0.647, respectively. Number of days taken to tasseling had positive association with all traits except 100-grain weight. Number of days taken to silking was positively correlated with number of days taken to tasseling both at genotypic and phenotypic levels (0.969 and 0.906) respectively. Number of days taken to silking had positive association with ear length, number of kernel rows ear^{-1}, number of kernel row^{-1} and grain yield plant^{-1} whilst the relationship of this trait with 100-grain weight was negative. Ear length was positively correlated with number of kernel rows ear^{-1} and 100-grain weight whilst relationship of this trait with number of kernels row^{-1} (r_g = 0.968 r_p =0.888) and grain yield plant^{-1} (r_g = 0.936 r_p = 0.862) was positive and highly significant. Number of kernel rows ear^{-1} had positive correlation with number of kernel row^{-1} and grain yield plant^{-1} and negatively correlated with 100-grain weight. Number of kernels row^{-1} had positive correlation with 100-grain weight and positive and highly significant correlation with grain yield plant^{-1} (r_g = 0.861 r_p = 0.806). There was a positive correlation between 100-grain weight and grain yield plant^{-1}. Although similar results were found by Debnath (1991), Ahmad (1997) and Singh *et al* (2000), who concluded positive correlation of various yield components with grain yield. Their findings varied only for the 100-grain weight. It might be due to differences in genetic materials or certain other factors. The genetic association concluded that selection for ear length and number of kernels row^{-1} would likely boost the grain yield plant^{1} in maize.

REFERENCES

Afzal, M., M. Sharif and M.H. Chaudhry, 1997. Genetic and path coefficient analysis studies in maize. *Pakistan J. Agric. Res*., 35: 360–8

Ahmad, S., 1997. Response to selection for grain yield and its components in a maize population. *M.Sc. Thesis* Department of Plant Breeding and Genetics University of Agriculture, Faisalabad–Pakistan

Ajmal, S.U., K. Sohail. M. Saleem and M.I. Haq, 2000. Association analysis for grain yield and yield components in maize. *Pakistan J. Pl. Sci*., 6: 12–7.

Anonymous, 2000. *Agricultural Statistics of Pakistan*. Ministry of Food, Agriculture and Livestock (Economic Wing), Islamabad

Debnath, S.C., 1991. Genetic variability in maize (*Zea mays* L.). *Bangladesh. J. Agric. Res*., 12: 217–21

Kown, S.H. and J.H. Torrie, 1964. Heretability and inter–relationship among traits of two soya been populations. *Crop Sci*., 4: 196–8

Mulk, M.Ul., 1990. *Farmer Strategies and Sustainability of Mountains Agriculture, a case study in Chitral, Pakistan*. pp: 479–83. Report of ICIMOD commissioned field study

Rehman, M.M., M.R. Ali and M. Sultan, 1995. Correlation and path coefficient studies in maize composites. *Bangladesh J. Sci. Ind. Res*., 30: 87–92

Singh, J.M. and B. Dash, 2000. Analysis of genetic variability and character association in maize. *African Crop Sci. J*., 5: 1–8

Steel, R.G.D. and J.H. Torrie, 1980. *Principles and Procedure of Statistics. A Biometrical Approach*. McGraw Hill. Co., New York

Zahur, A., 1993. *Horticulture Development in Hindukash Himalayan Region*. pp: 212–5. Development of Horticulture the mountain regions of Pakistan progress potential and constraints. Oxford & IBH publishing Co., New Dehli

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