Frontiers in Crop Improvement 1(2) : 192-196 (2013)

PATH AND CORRELATION ANALYSIS IN ELITE LANDRACES OF MAIZE GENOTYPES

Avinash Jha, D.K. Mishra, S.S. Porte, Abhishek Jha, Jeetendra Shivhare and Rajkumar Kuldeep
Dept of Plant Breeding and Genetics College of Agriculture, JNKVV Jabalpur (M.P)
Email : avinashjha149@gmail.com

ABSTRACT

The present investigation aimedto find outthe association among yield and its components and to sort out the traits that are directly or indirectly contributing towards yield in elite landraces of maize genotypes. Sixty-four genotypes of maize (*Zea Mays* L.) were grown in single environment and subsequently analyzed which revealed that grain yield per plant was observed to be positively associated with ear weight, biological yield per plant, cob diameter, 100 grain weight, ear length, ear height from ground, stem girth, harvest index, plant height, number of rows per ear and number of prop roots. While Path coefficient analysis has revealed that biological yield per plant, harvest index (%), days to 50% male flowering and ear weight were the main yield contributing characters and should be given more emphasis

Key words: *Maize, elite landraces, associated andpath coefficient analysis*

Maize (*Zea Mays* L.) belongs to family graminae (2n=2x=20) and is an important staple food of many countries, particularly in the tropics and subtropics. It is third most important cereal food crop of the world after Rice and Wheat (1). This cereal is referred as Miracle crop and Queen of the Cereals due to its high productivity potential compared to other Poaceae family members. In India total production of Maize accounts 21.23 mt. with an area of 8.26 mha and productivity was 2570.20 kg / ha during 2010-11. The total utilization of maize in India is 52 % in poultry feed (Poultry, Pig, Fish etc.) 24 % for food, 11% for cattle feed, 11% for starch, 1 % each for brewery and seed purposes. The maize crop has attributes to adapt and to face various stresses enabling it to survive and thrive in a diverse range of agro climatic niches. On global front, maize has gained tremendous importance due to rising demand from diversified sectors like human food, animal feed, ethanol production and as good source of starch, protein, fat, oil and sucrose in addition to some of the important vitamins and minerals. It is also used for the preparation of corn syrup, corn oil, corn flakes, gluten, grain cake, lactic acid and acetone, which are used by various industries such as textile, fermentation and food industries. Maize oil has high calorific value and is highly suitable especially for heart patients. Maize contains a high percentage of unsaturated fatty acids like oleic acid and linoleic acid and has a very low content of cholesterol. With the development of poultry and livestock industry, its consumption in the feeds has also increased tremendously.

The character association reveals the type, nature and magnitude of correlation between yield components with yield and among themselves. To increase the yield, study of direct and indirect effects of yield components provides the basis for its successful breeding programme and hence the problem of yield increase can be more effectively tackled on the basis of performance of yield components and selection for closely related characters (2). On the other hand, path coefficient analysis measures the direct and indirect effect for one variable upon another and permits the partitioning of the correlation coefficient into direct and indirect effect (3). Therefore, the present investigation aimedto find outthe association among yield and its components and to sort out the traits that are directly or indirectly contributing towards yield in elite landraces of 64 maize genotypes.

MATERIALS AND METHODS

The experimental material consisting of 62 desi maize varieties and 2 checks collected from different parts of M.P. These varieties were sown in ridges and furrows during *Rabi*,2012-13 in a Randomized Complete Block Design replicated thrice, at Seed Breeding Farm Department of Plant Breeding and Genetics College of Agriculture JNKVV Jabalpur. Each variety was sown in 3 rows of 4 m length adopting a spacing of 60 cm between rows and 20 cm between the plants. All the recommended package of practices was followed to obtain proper plant stand in the experiments. The

Table-1: Phenotypic and genotypic correlation between yield andother characters.

Character	C.M	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{15}	X_{16}	X_{17}	X_{18}	X_{14}
x_1	rG	1.0000	0.6682	0.1900	0.1965	0.1916	0.2045	0.1471	0.1907	0.1480	0.2338	0.3205	0.1524	0.1099	0.3875	-0.0759	0.2733	0.0789	0.3253
	rP	1.0000	0.6665**	0.1810*	0.1891**	0.1770*	0.1958**	0.1429*	0.1892**	0.1305	0.2310**	0.3198**	0.1513*	0.1074	0.3865**	-0.0756	0.2483**	0.0787	0.3239**
x_2	rG		1.0000	0.3633	0.3504	0.3863	0.3616	0.3088	0.2004	0.1935	0.3679	0.3935	0.0854	0.2874	0.4461	-0.0539	0.1136	0.0055	0.3772
	rP		1.0000	0.3444**	0.3342**	0.3557**	0.3393**	0.3023**	0.2002**	0.1776*	0.3634**	0.3927**	0.0881	0.2825**	0.4454**	-0.0532	0.0982	0.0055	0.3765**
x_3	rG			1.0000	0.9790	0.9975	0.9782	0.5570	0.1433	-0.0104	0.3087	0.1727	0.1179	0.1788	0.1569	-0.0065	0.2683	-0.0314	0.1098
	rP			1.0000	0.9667**	0.9529**	0.9307**	0.5347**	0.1340	-0.0062	0.2868**	0.1650*	0.1114	0.1651*	0.1500*	-0.0059	0.2268**	-0.0302	0.1053
x_4	rG				1.0000	0.9763	0.9852	0.5463	0.0837	-0.0406	0.3027	0.1286	0.1244	0.1600	0.1460	-0.0371	0.2840	-0.0358	0.0735
	rP				1.0000	0.9218**	0.9385**	0.5250**	0.0752	-0.0316	0.2841**	0.1232	0.1172	0.1502*	0.1400	-0.0357	0.2417**	-0.0345	0.0706
x_5	rG					1.0000	0.9905	0.5921	0.1416	-0.0045	0.3089	0.2143	0.1216	0.2163	0.2039	-0.0393	0.2589	-0.0127	0.1331
	rP					1.0000	0.9441**	0.5470**	0.1300	0.0250	0.2803**	0.2016**	0.1140	0.1884	0.1888**	-0.0320	0.2165**	-0.0118	0.1259
x_6	rG						1.0000	0.5737	0.1370	-0.0550	0.3197	0.2050	0.1359	0.2058	0.2093	-0.0409	0.2679	-0.0516	0.1412
	rP						1.0000	0.5366**	0.1297	-0.0416	0.2911**	0.1923**	0.1254	0.1843*	0.1970**	-0.0382	0.2400**	-0.0486	0.1326
x_7	rG							1.0000	0.1069	0.1363	0.3130	0.1926	0.1234	0.1487	0.2304	-0.0946	0.2767	-0.1101	0.1043
	rP							1.0000	0.1070	0.1332	0.3037**	0.1894**	0.1184	0.1429*	0.2264**	-0.0904	0.2309**	-0.1083	0.1030
x_8	rG								1.0000	0.3130	0.3099	0.4750	0.2961	0.1931	0.3533	0.1242	-0.0132	0.0265	0.4649
	rP								1.0000	-0.0491	0.3066**	0.4719**	0.2954**	0.1842*	0.3505**	0.1265	-0.0120	0.0262	0.4628**
x_9	rG									1.0000	0.0458	0.3604	-0.0991	0.2340	0.0985	0.3890	0.2543	0.1060	0.3500
	rP									1.0000	0.0385	0.3297**	-0.0827	0.2027**	0.0891	0.3559**	0.2166**	0.0961	0.3201**
x_{10}	rG										1.0000	0.6061	0.2515	0.3494	0.5423	0.0439	0.0736	-0.2009	0.5562
	rP										1.0000	0.5998**	0.2460**	0.3384**	0.5342**	0.0479	0.0532	-0.1978**	0.5498**
x_{11}	rG											1.0000	0.3262	0.6464	0.7437	0.2194	0.2056**	-0.1059	0.9246
	rP											1.0000	0.3229**	0.6361**	0.7429**	0.2197**	0.2056	-0.1058	0.9232**
x_{12}	rG												1.0000	0.1519	0.5786	-0.3143	0.0267	-0.4150	0.3639
	rP												1.0000	0.1446*	0.5714**	-0.3080**	0.0217	-0.4097**	0.3601**
x_{13}	rG													1.0000	0.5812	0.0419	0.1281	-0.1374	0.6115
	rP													1.0000	0.5737**	0.0367	0.1166	-0.1358	0.5998**
x_{15}	rG														1.0000	0.3736	0.1410	-0.1993	0.7232
	rP														1.0000	-0.3724	0.1268	-0.1992**	0.7225**
x_{16}	rG															1.0000	0.3206	0.1316	0.3376
	rP															1.0000	0.2913**	0.1312	0.3394**
x_{17}	rG																1.0000	0.0941	0.3478
	rP																1.0000	0.0850	0.3110**
x_{18}	rG																	1.0000	-0.1099
	rP																	1.0000	-0.1097

*, **Significant at 5 and 1%; levels, respectively.

X1 =Plant height, X2 = Ear height from ground, X3 =Days to male flower initiation, X4 = Days to female flower initiation, X5 = Days to 50 per cent tasseling, X6 = Days to 50 per cent silking, X7 = Days to maturity, X8 = Ear length, X9 = Number of rows per ear, X10=100-Grainweight, X11=Ear weight, X12= Stem girth, X13=Cob diameter, X14=Grain yield per plant, X15=Biological yield, X16=Harvest index, X17=No. of prop roots, X18=Lodging %

Table-2: Path coefficient based on genotypic correlation coefficient.

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X15	X16	X17	X18	**X14**
X1	**0.0120**	0.0046	-0.0718	-0.0181	0.0752	0.0111	-0.0122	0.0036	-0.0033	0.0040	0.0717	0.0078	0.0002	0.2748	-0.0428	0.0134	-0.0016	0.3286
X2	0.0080	**0.0069**	-0.1374	-0.0420	0.1516	0.0196	-0.0256	0.0038	-0.0043	0.0063	0.0880	0.0043	0.0005	0.3163	-0.0304	0.0056	-0.0001	0.3711
X3	0.0023	0.0025	**-0.3782**	-0.0900	0.3914	0.0530	-0.0462	0.0027	0.0002	0.0053	0.0386	0.0060	0.0003	0.1112	-0.0036	0.0132	0.0006	0.1093
X4	0.0024	0.0024	-0.3703	**-0.0920**	0.3831	0.0534	-0.0453	0.0016	0.0009	0.0052	0.0287	0.0063	0.0003	0.1035	-0.0209	0.0139	0.0007	0.0739
X5	0.0023	0.0027	-0.3773	-0.0898	**0.3924**	0.0537	-0.0491	0.0027	0.0001	-0.0045	0.0479	0.0062	0.0004	0.1446	-0.0222	0.0127	0.0003	0.1231
X6	0.0025	0.0025	-0.3700	-0.0906	0.3886	**0.0542**	-0.0476	0.0026	0.0012	0.0055	0.0458	0.0069	0.0004	0.1484	-0.0231	0.0131	0.0010	0.1414
X7	0.0018	0.0021	-0.2107	-0.0502	0.2323	0.0311	**-0.0829**	0.0020	-0.0031	0.0054	0.0431	0.0063	0.0003	0.1634	-0.0534	0.0136	0.0022	0.1033
X8	0.0023	0.0014	-0.0542	-0.0077	0.0556	0.0074	-0.0089	**0.0188**	0.0014	0.0053	0.1062	0.0151	0.0003	0.2505	0.0701	-0.0006	-0.0005	0.4625
X9	0.0018	0.0013	0.0039	0.0037	-0.0018	-0.0030	-0.0113	-0.0012	**-0.0224**	0.0008	0.0806	-0.0050	0.0004	0.0698	0.2197	0.0125	-0.0022	0.3476
X10	0.0028	0.0025	-0.0117	-0.0278	0.1212	0.0173	-0.0260	0.0058	-0.0010	**0.0171**	0.1355	0.0128	0.0006	0.3845	0.0248	0.0036	0.0041	0.6661
X11	0.0039	0.0027	-0.0653	-0.0118	0.0841	0.0111	-0.0160	0.0090	-0.0081	0.0104	**0.2236**	0.0166	0.0011	0.5274	0.1239	0.0112	0.0022	0.9260
X12	0.0018	0.0006	-0.0446	-0.0114	0.0477	0.0074	-0.0102	0.0056	0.0022	0.0043	0.0729	**0.0509**	0.0003	0.4103	-0.1775	0.0013	0.0084	0.3700
X13	0.0013	0.0020	-0.0676	-0.0147	0.0849	0.0112	-0.0123	0.0036	-0.0052	0.0060	0.1445	0.0077	**0.0017**	0.4121	0.0237	0.0063	0.0028	0.6080
X15	0.0047	0.0031	-0.0593	-0.0134	0.0800	0.0113	-0.0191	0.0067	-0.0022	0.0093	0.1663	0.0295	0.0010	**0.7091**	-0.2110	0.0069	0.0041	0.7270
X16	-0.0009	-0.0004	0.0024	0.0034	-0.0154	-0.0022	0.0078	0.0023	0.0087	0.0007	0.0491	-0.0160	0.0001	-0.2649	**0.5648**	0.0157	-0.0027	0.3525
X17	0.0033	0.0008	-0.1015	-0.0261	0.1016	0.0145	-0.0229	-0.0002	-0.0057	0.0013	0.0512	0.0014	0.0002	0.1000	0.1810	**0.0490**	-0.0019	0.3460
X18	0.0010	0.0000	0.0119	0.0033	-0.0050	-0.0028	0.0091	0.0005	-0.0024	-0.0034	-0.0279	-0.0211	-0.0002	-0.1413	-0.0743	0.0046	**-0.0203**	-0.2683

Residual effect – 0.1795; R^2 - 0.9678

X1 =Plant height, X2 = Ear height from ground, X3 =Days to male flower initiation, X4 = Days to female flower initiation, X5 = Days to 50 per cent tasseling, X6 = Days to 50 per cent silking, X7 = Days to maturity, X8 = Ear length, X9 = Number of rows per ear, X10=100-Grainweight, X11=Ear weight, X12= Stem girth, X13=Cob diameter, X14=Grain yield per plant, X15=Biological yield, X16=Harvest index, X17=No. of prop roots, X18=Lodging %

** Significant at 1%

materials used in the study comprised of 62 desi maize varieties (JLM 1, JLM 2, JLM 3, JLM 4, JLM 5, JLM 6, JLM 7, JLM 8, JLM 9, JLM 10, JLM 11, JLM 12, JLM 13, JLM 14, JLM 15, JLM 16, JLM 17, JLM 18, JLM 19, JLM 20, JLM 21, JLM 22, JLM 23, JLM 24, JLM 25, JLM 26, JLM 27, JLM 28, JLM 29, JLM 30, JLM 31, JLM 32, JLM 33, JLM 34, JLM 35, JLM 36, JLM 37, JLM 38, JLM 39, JLM 40, JLM 41, JLM 42, JLM 43, JLM 44, JLM 45, JLM 46, JLM 47, JLM 48, JLM 49, JLM 50, JLM 51, JLM 52, JLM 53, JLM 54, JLM 55, JLM 56, JLM 57, JLM 58, JLM 59, JLM 60, JLM 61, JLM 62) and 2 checks JM 216 and HKI 1344 collected from different parts of M.P. Sowing was done on 1st week of January.

Observations were recorded on five competitive plants in each genotype per replication and mean values plant basis were obtained. The data were used to carry out Path coefficient analysis (3, 4) and Correlation analysis. In order to find out the association among yield and its components and to sort out the traits that are directly or indirectly contributing towards yield.

RESULTS AND DISCUSSION

Most of the characters are associated with each other but the extent of correlation values varies with different characters pairs. A positive correlation between the desired characters is favorable to the breeder as it helps in selection. However, a negative correlation hinders the recovery of the recombinants in both characters. In such a situation any strong selection applied to a character also bring about change in other character.

A perusal of phenotypic correlation coefficients worked out in the present study revealed that among the 18 component characters studied, eleven traits had significant positive correlation with grain yield per plant. Based on the strength of correlations, these eleven traits were ordered as ear weight followed by biological yield per plant, cob diameter, 100 grain weight, ear length, ear height from ground, stem girth, harvest index, plant height, number of rows per ear and number of prop roots. In the previous studies, (5) for ear weight; (6) for ear diameter. (7) for 100-grain weight, ear length, kernel rows per cob, biological yield per plant and harvest index; (8) for ear length, (9) for plant height and ear height from ground; (10) for number of rows per ear have also reported high positive phenotypic correlations with grain yield per plant.

Hundred grain weight showed significant positive correlation with twelve traits *viz*., ear weight, stem girth, cob diameter, biological yield per plant, plant height, ear height from ground, days to flower initiation male, days to flower initiation female days to 50% male flowering, days to 50% female flowering, days to maturity, and ear length (0.3066) while significant negative inter-correlation was also recorded for this trait with lodging %

Ear weight showed significant positive correlation with six traits *viz*. cob diameter, biological yield per plant, plant height, ear length, 100 grain weight and ear weight, while significant negative inter-correlation was recorded for this trait with harvest index and lodging %.

Biological yield per plant registered significant positive correlation with 11 traits viz. plant height, ear height from ground, days to flower initiation male, days to 50% male flowering, days to 50% female flowering, days to maturity, ear length, 100-grain weight, ear weight, stem girth and cob diameter. While the trait registered only significant negative correlation with lodging %.

Harvest index registered significant positive correlation with 3 traits viz. number of prop roots, ear weight and number of rows per ear while the trait stem girth registered only significant negative correlation harvest index.

Lodging % registered only significant negative correlation with biological yield per plant, stem girth, and 100 grain weight.

In the present investigation, positive correlation coefficient between any two characters suggested that they can improve simultaneously and improvement in one will automatically improve the other. However, such simultaneous improvement is not possible for those traits that are negatively correlated. Therefore such traits can be improved by indirect selection.

Path coefficient analysis is the most widely used biometrical technique in plant breeding. The information obtained from this technique, also helps in making selection based on component characters of yield. It helps in understanding the cause of association between two variables. It determines the

direct effect of various characters on yield and also indirect effects *via* other components characters and provides the selection of superior genotypes.

In the present investigation path coefficient analysis has been performed at genotypic and phenotypic level taking seed yield per plant as dependent variable. In general genotypic direct and indirect effects were slightly higher in magnitude as compared to phenotypic effects.

In the present study biological yield per plant, harvest index, days to 50% male flowering, and ear weight, had positive direct effect on grain yield per plant hence direct selection for such traits may be rewarding in other words these traits should be given importance while practicing selection, aimed at improvement of seed yield per plant in maize.

The high positive direct effects of biological yield per plant and harvest index were reported by (11). While high positive direct effects of ear weight and days to 50 per cent tasseling were also substantiated by (12) while reversely (7) observed negative direct effect of days to 50 per cent tasseling on grain yield per plant The above findings indicated that the above characters may be given prime importance in a selection programme for grain yield improvement in maize, as this character exhibited high direct effect on grain yield per plant.

The above findings indicated that the ear weight and biological yield per plant alone may be given prime importance in a selection programme for grain yield improvement in maize, as this character exhibited strong positive correlation as well as high direct effect with grain yield per plant. However days to male flower initiation had direct negative effect on grain yield/plant.

In general biological yield per plant and harvest index exhibited high indirect positive effect on grain yield per plant via other traits Mainly days to male flower initiation exhibited high indirect negative effect on grain yield per plant via other traits. Majority of indirect effects of various independent traits via other traits were extremely low of either signs. Hence in the selection programme these indirect effect must be given due importance.

The study on correlation and path coefficient revealed that the traits biological yield per plant, harvest index and ear weight showed positive and significant correlation with seed yield per plant as well as it have direct effect on seed yield . Thus these traits might be considered for selecting the high yielding genotypes.

REFERENCES

1. Poehlman, J.M. (2006). Breeding Field Crops. 5th Edn. The AVI publish. Co. Inc. Westport, Connecticut.
2. Choudhary, A.K. and L.B. Choudhary (2002). Genetic studies in some crosses of maize (*Zea mays* L.).*J. Res. (BAU). 14(1):* 87-90.
3. Dewey, D.R. and K.H. Lu (1959). A correlation and path analysis of components of crested wheat grass seed production. *Agron. J., 51:* 515-518.
4. Wright, S. (1921). Correlation and causation. *J. Agric. Res., 20 :* 202-209.
5. Vaezi, S., C. Abd-Mishani, B. Yazdi-Samadi and M.R. Ghannadha (2000). Correlation and path analysis of grain yield and its components in maize. *Iranian J. Agric. Sci., 31(1):* 71-83.
6. Ei-Shouny, K.A., O.H. Ei-Bagowly, K.I.M. Ibrahim and S.A. Al-Ahmad (2005). Correlation and path analysis in four yellow maize crosses under two planting dates. *Arab Univ. J. Agric. Sci., 13(2):* 327-339.
7. Mohan, Y.C., D.K. Singh and N.V. Rao (2002).Path coefficient analysis for oil and grain yield in maize (*Zea mays* L.) genotypes. *National J. plant Improvement., 4(1):* 75-76.
8. Pradeep Kumar, P. and E. Satyanarayana (2001). Variability and correlation studies of fall season inbred lines of maize. *J. Res., ANGRAU,* Hyderabad, India*, 29:* 71-75.
9. Wali, M.C., P.M. Salimath, M. Prashanth and S.I. Harlapur (2006). Studies on character association as influenced by yield, starch and oil in maize (*Zea mays* L.). *Karnataka J. Agric. Sci., 19(4) :* 932-935.
10. Sofi, P.A. and A.G. Rather (2007). Studies on genetic variability, correlation and path analysis in maize (*Zea mays* L.). *Maize Genetics Co-operation News lett., 81:* 26-27.
11. Sandeep Kumar, T., D. Mohan Reddy, K. Hariprasad Reddy and P. Sudhakar (2011). Targeting of traits through assessment of interrelationship and path analysis between yield and yield components for grain yield improvement in single cross hybrids of maize (*Zea mays* L.). *International Journal of Applied Biology and Pharmaceutical Technology, 2(3):* 123-129.
12. Gopal, M.V., N.A. Ansari and T. Rajanikanth (2003). Correlation and path analysis in maize (*Zea mays* L.). *Crop Research, Hisar., 25(3):* 525-529.

Received : April-2013; Revised : May-2013; Accepted : June-2013