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# Study of Trait Alliance with Grain yield, Its Attributes of Different Land Races of Maize (*Zea Mays* L.)

**R. A. GAMI*, J.M.PATEL, G. K. CHAUDHARY and S. M. CHAUDHARY**

Maize Research Station, S.D. Agricultural University,
Bhiloda-383 245 Gujarat, India.

**Abstract**

The research was carried out to study the correlation and path coefficient analysis of 51different land races of maize for yield and component traits. Analysis of correlation between different characters suggested that the value of genotypic correlation were some what higher as compared to their corresponding phenotypic correlations signified the inherent relationship among the characters. Grain yield kg per ha. showed significant positive association with days to 50% pollen shed, days to 50% silking, days to 75% dry husk, number of cobs per plot, cob weight per plot and shalling perportion at both genotypic and phenotypic levels. Path co-efficient analysis revealed that the maximum positive direct effects of cob weight per plot, shelling perportion, ear height and number of cobs per plot towards grain yield. This finding suggested that more emphasis should be given to number of cobs per plot, cob weight per plot and shalling perportion in selection programmes aiming to improve grain yield in maize.

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Land races, Genotypic correlation, Phenotypic correlations and Path co-efficient.

## Introduction

Maize (*Zea mays* L.; 2n=20) is one of the most important economic cereal crops of the world. It was domesticated over the past 10,000 years from the grass teosinte in Central America[1]and has been subject to cultivation and selection ever since. It ranks one of the three important cereal crops in the world after wheat and rice for production and consumption. Maize is also considered as primary staple food in many developing countries. Maize grain is gaining popularity and huge demand in our country due to, Nutritionally important and has multiple function of traditional farming system, it has diversified uses as food for human, live stocks and

**CONTACT** R. A. Gami ramangami@gmail.com Maize Research Station, S.D. Agricultural University, Bhiloda-383 245 Gujarat, India.



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poultry. It is also a source of industrial raw material for the production of flour, flakes, corn starch, corn oil, corn syrup, glucose, alcohol, ethanol, gluten, dextrose, custard powder and many more products, besides these, it's also used for making glue, soaps, insecticides, toothpaste, shaving cream, rubber tires, rayon, model plastic, etc.,[2].With the introduction of hybrids in maize, the inclinations of acreage and

**Table 1: Analysis of variance (ANOVA) showing mean squares of different traitsin maize**

| Source of variation | d.f. | Days to 50% Pollen shed | Days to 50% Silking | Days to 75% Dry husk | Plant Height (cm.) | Ear Height (cm.) | Number of Cobs per Plot | Cob wt. per Plot (Kg) | 100-seed weight | Shelling (%) | Grain yield (kg/ha) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Replication | 1 | 0.353 | 1.41 | 20.75 | 118.2 | 8.76 | 4.75 | 0.15 | 0.41 | 9.24 | 329872.2 |
| Genotypes | 50 | 8.05** | 10.25* | 18.27* | 455.28** | 309.56** | 10.12* | 0.56** | 14.69** | 39.29** | 2792128.8** |
| Error | 50 | 3.03 | 5.23 | 9.27 | 146.38 | 66.09 | 5.47 | 0.13 | 4.69 | 12.32 | 663670.96 |
| S.Em.± | | 1.22 | 1.6 | 2.13 | 8.47 | 5.69 | 1.64 | 0.25 | 1.51 | 2.45 | 570.38 |
| C.D. at 5% | | 3.5 | 4.59 | 6.11 | 24.3 | 16.33 | 4.7 | 0.72 | 4.35 | 7.06 | 1636.3 |
| C.V. % | | 3.09 | 3.78 | 3.69 | 6.82 | 8.88 | 8.94 | 20.83 | 8.15 | 4.42 | 21.38 |

*,** Significant at 5 % and 1%level respectively

**Table 2: Genotypic and phenotypic correlation co-efficients for various characters in maize**

| Characters | | Days to 50% Pollen | Days to 50% Silking | Days to 75% Dry husk | Plant Height (cm.) shed | Ear Height (cm.) | Number of Cobs per Plot | Cob wt. per Plot (Kg) | 100-seed weight | Shelling (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| Grain yield (kg/ha) | rg | 0.440** | 0.498** | 0.541** | 0.056 | 0.106 | 0.262* | 0.979** | -0.230* | 0.358** |
| | rp | 0.300** | 0.197* | 0.216* | 0.105 | 0.132 | 0.162 | 0.979** | -0.05 | 0.300** |
| Days to 50% Pollenshed | rg | | 1.463** | 0.957** | -0.036 | 0.11 | 0.109 | 0.402 | -0.081 | 0.409** |
| | rp | | 0.515** | 0.349** | 0.019 | 0.069 | 0.087 | 0.283** | -0.133 | 0.174 |
| Days to 50% Silking | rg | | | 1.261** | 0.164 | 0.385** | 0.340** | 0.410** | -0.04 | 0.939** |
| | rp | | | 0.482** | 0.067 | 0.115 | 0.084 | 0.165 | -0.0003 | 0.257** |
| Days to 75%Dryhusk | rg | | | | -0.387** | -0.178 | -0.08 | 0.501** | -0.235* | 0.434** |
| | rp | | | | -0.296** | -0.165 | -0.013 | 0.217* | -0.001 | 0.126 |
| Plant Height(cm.) | rg | | | | | 0.915** | 0.572** | 0.02 | 0.245* | 0.378** |
| | rp | | | | | 0.847** | 0.244* | 0.08 | 0.111 | 0.157 |
| Ear Height(cm.) | rg | | | | | | 0.382** | 0.055 | 0.196 | 0.415** |
| | rp | | | | | | 0.283** | 0.104 | 0.043 | 0.177 |
| Number of Cobs per Plot | rg | | | | | | | 0.139 | -0.255** | 1.160** |
| | rp | | | | | | | 0.124 | 0.013 | 0.296** |
| Cob wt. per Plot (Kg) | rg | | | | | | | | -0.224* | 0.211* |
| | rp | | | | | | | | -0.022 | 0.144 |
| 100-seed weight | rg | | | | | | | | | -0.114 |
| | rp | | | | | | | | | -0.121 |

*, ** Significant at P = 5 and 1 per cent levels, respectively.

production have been an increasing due to its high yield potential. In India, it is grown round the year in an area of 9.43 million hectares with the production of 21.81 million tonnes and 2509 kg/ha productivity, whereas, in Gujarat, it covers an area of 0.39 million hectares with a total production of 0.57 million tonnes with 1478 kg/ha productivity [3].

Due to complex nature of yield direct selction based on *per se* performance may not effective, in such case indierect selection for yield attributes with high heritability estimates will be more effective. Genotypic correlation had been considered as a effective tool to investigate the interrelationship among agronomic traits in genetically diverse population[4]. The study of correlation alone is not enough to provide of related importance of direct or indirect influences of each of the component characters on seed yield. In this context, path co-efficient analysis is an important tool for plant breeders in partitioning the genotypic correlation co-efficient into the direct and indirect effects of independent variables on the dependant variable *i.e.,* kernal yield. Information on character association in crop is important for effective and rapid

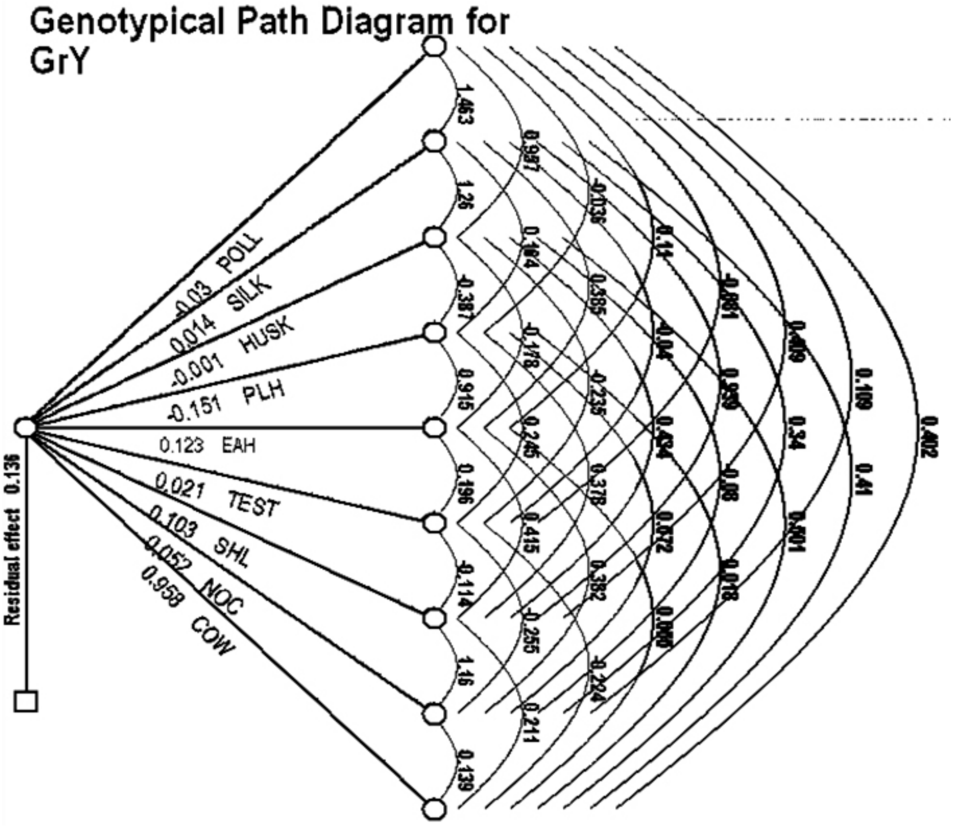


**Fig. 1: Path diagram showing reation between yield with its componets**

Where:-

| | |
|---|---|
| **Gry**= Grain yield (kg/ha) | **EAH**= Ear height (cm) |
| **POLL**= Days to 50% pollen shed | **TEST**= 100- seed weight |
| **SILK**= Days to 50% silking | **SHL** = Shalling (%) |
| **HUSK**= Days to 50% dry husk | **NOC**= Number of cobs per plot |
| **PLH**=Plant height (cm) | **COW**= Cob weight per plot (kg) |

selection in crop breeding [5]. Thus the objective of present study was to know the relationship between kernel yield and yield contributing characters, hence correlation co-efficient of these yield attributing characters with kenal yield and to utilize these parameters *i.e.* correlation coefficient and path analysis for further improvement in available germ plasm of land races.

**Material and Methods**

The experiment was carried out to evaluate51 different land races of maize. The experiment was conducted in randomized block design at Maize Research Station, S. D. Agricultural University, Bhiloda during *kharif* 2016. Each genotype was grown in two rows of 3m length with 60 x 20 ($cm^2$) spacing. The size of net plot was 3.6$m^2$ and each plot >90 per cent plant population were maintained. The data were recorded from five randomly selected plants from each entry in each replication for plant height (cm), ear height (cm), 100 seed weight (g) and shelling (%) whereas days to 50 % tasseling, days to 50% silking days to 75 % dry husk were recorded on visual basis per plot while number of cobs and cob weight measured from plot basis. The grain yield (kg/ ha.) for each genotype was estimated with modification of method mentioned by[6]. The yield was estimated by reducing grain moisture content to 15% with step wise formula. (a) grain yield at observed grain moisture content [*. cob yield (kg/plot) at harvest x Multiple factor for ha x shelling proportion (%)], (b) grain dry matter content = 1- moisture per cent at harvest, (c) grain yield at 15% grain moisture content=[(grain yield at observed grain moisture content x grain dry matter content)/0.85], (d) grain yield at 15 % grain moisture content = [(grain yield at 15% grain moisture content)/100]. The mean of the data recorded were used for statistical analysis. The analysis of variance was calculated with the method suggested by[7]. The co-efficients of phenotypic and

**Table 3: Path co-efficient analysis showing direct and indirect effects of nine causal traits on grain yield in maize**

| Characters | Days to 50% Pollen shed | Days to 50% Silking | Days to 75% Dry husk | Plant Height (cm.) | Ear Height (cm.) | Number of Cobs per Plot | Cob wt. per Plot (Kg) | 100-seed weight | Shelling (%) | Genotypic Correlation with grain yield |
|---|---|---|---|---|---|---|---|---|---|---|
| Days to 50% Pollenshed | -0.03 | 1.463 | 0.957 | -0.036 | 0.11 | 0.109 | 0.402 | -0.081 | 0.409 | 0.44 |
| Days to 50% Silking | -0.044 | 0.014 | 1.261 | 0.164 | 0.385 | 0.34 | 0.41 | -0.04 | 0.939 | 0.498 |
| Days to 75% Dryhusk | -0.029 | 0.018 | -0.001 | -387 | -0.178 | -0.08 | 0.501 | -0.235 | 0.434 | 0.541 |
| Plant Height (cm.) | 0.001 | 0.002 | 0 | -0.152 | 0.915 | 0.572 | 0.018 | 0.245 | 0.378 | 0.056 |
| Ear Height(cm.) | -0.003 | 0.005 | 0 | -0.139 | 0.123 | 0.382 | 0.055 | 0.196 | 0.415 | 0.106 |
| Number of Cobs per Plot | -0.003 | 0.005 | 0 | -0.087 | 0.047 | 0.052 | 0.139 | -0.255 | 1.16 | 0.262 |
| Cob wt. per Plot(Kg) | -0.012 | 0.006 | 0 | -0.003 | 0.007 | 0.007 | 0.958 | -0.224 | 0.211 | 0.979 |
| 100-seed weight | 0.002 | -0.001 | 0 | -0.037 | 0.024 | -0.005 | -0.005 | 0.021 | -0.114 | -0.23 |
| Shelling (%) | -0.012 | 0.014 | 0 | -0.057 | 0.051 | -0.002 | 0.022 | -0.005 | 0.103 | 0.358 |

*, ** Significant at P = 5 and 1 per cent levels, respectively.

Note : 1. Bold diagonal values indicates direct effect. Residual effect = 0.136 and R2= 0.981

genotypic variations were calculated by formula suggested by[8].The estimation of direct and indirect contribution of various seed yield contributing characters, showing high genotypic correlation co-efficient with seed yield in individual analysis, was carried as suggested by[9] and elaborated by[10].

**Result and Discussion**

Yield is a complex character and it is multiplicative end product of other quantitative traits as components of the yield[11]. Hence, the selection of superior genotypes based on yield as such would not be more valuable, but several yield attributes have to be handled together. Improvement in yield potential would be more reliable, if indirect selection is made based on the traits correlated with yield. Thus, for rational improvement of yield and its components, the understanding of correlation of yield with different yield contributing characters has been very useful. This association should be at genotypic level by eliminating the environmental influence from the phenotypic values.

The analysis of variance revealed the existence of considerable genetic differences among the genotypes for all the traits (Table 1). This indicated suitability of experimental material for estimation of genetic parameters. In general the values for genotypic correlation were slightly higher than their phenotypic counterparts. This indicated that though there was a high degree of association between two variables at genotypic levels, but its phenotypic expression was deflated by the influence of environment. All the traits except 100-seed weight showed positive correlation with grain yield at both genotypic and phenotypic levels. Characters, days to 50% pollen shed, days to 50% silking, days to 75% dry husk, cob weight per plot and shelling perportion showed significant positive correlation co-efficient at phenotypic level (Table2). Such positive interrelationship between grain yield and its attributes have also been reported in maize by several researchers *i.e.,*[12,13,14,15,16,17]. Thus, these attributes were more influencing the grain yield in maize and they can serve as important yield contributing traits for improvement in grain yield.

Days to 50% silking ($r_g$ =0.340), plant height ($r_g$ =0.572, $r_p$=0.244), ear height ($r_g$=0.382, $r_p$=0.283), and shelling per cent ($r_g$ = 1.160, $r_p$ =0.296) at genotypic level as well as well as phenotypic level except days to 50% silking exhibited significantly positive correlation with the number of cobs per plot. The association of 100-seed weight with number of cobs per plot ($r_g$ = -0.224) was significantly negative at genotypic level.

The ear height had significant positive correlation with plant height ($r_g$ = 0.915, $r_p$ = 0.847) at both genotypic level as well as phenotypic level, where as days to 75% dry husk had remain significant negative correlation with plant height ($r_g$ = -0.387, $r_p$ = -0.296) at both genotypic level as well as phenotypic level (Table 2).

In order to achieve a clear picture of interrelationship of various component characters with grain yield at genotypic level, direct and indirect effects of various characters on grain yield were calculated using path co-efficient analysis (Table 3).Path co-efficient analysis, ninetraits were considered as causal variable of grain yield. It was observed that considerable positive direct effects on grain yield were caused by cob weight per plot, shelling perportion, ear height and number of cobs per plot (Fig.1). These characters were thus important yield contributing traits in the present population of land races. The direct positive effects on grain yield were important in path co-efficient analyses carried out in maize by[16,18,19]. The residual effect was in the range of low to moderate (0.136), which indicates that there are some more character which contribute to the grain yield which need to be further study.

Among traits studied, the cob weight per plot is of more importance because; it showed the highest positive direct effect on grain yield along with significant correlation co-efficient (Table 3). Thus cob weight per plot should be the vital tool for increasing grain yield in the present population. This trait may be an important feature of an ideal plant type in maize.

Overall picture of path analysis in the this study revealed that selection through cob weight per plot, shelling perportion, ear height and number of cobs per plot may bring positive contribution to grain yield. Hence, it would be rewarding to lay more emphasis on these traits in selection programme for improvement of grain yield. Though the direct effect of test weight and days to 50% silking was not very high, but these traits affected the yield positively and indirectly through other traits. While different traits like days to 50% pollen shed, days to 75% husk and plant height had negative direct effect on seed yield indicating their limited role in yield improvement.

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