*Turkish Journal of Field Crops, 2011, 16(2): 105-107*

# CORRELATION AND PATH COEFFICIENT ANALYSES IN SWEET CORN

Emre İLKER

*Ege University, Faculty of Agriculture, Department of Field Crops. 35100 Izmir, Turkey*
*Corresponding author's email: emre.ilker@ege.edu.tr*

Received: 12.10.2011

**ABSTRACT**

**Aim of this study was to determine the selection criteria for plant breeders using correlation and path coefficient analyses in a sweet corn sub population comparing 8 varieties. The trials were arranged in the Randomized Completely Block Design with three replicates under drop irrigated conditions during the 2009 and the 2010 main growing seasons under the Mediterranean climatical conditions. Analyses were done by pooling over two years due to insignificant genotype x year interactions. In conclusion, fresh ear weight could be used as a selection criterion because of its highly positive direct effects on fresh grain yield as well as indirect effects on all other characters. Row number per ear and ear length could also be considered for selection in a sweet corn breeding.**

**Key words: sweet corn, fresh grain yield, correlation, path coefficient analyses**

## INTRODUCTION

Corn ranks third among the cereal crops worldwide after wheat and rice. Corn is produced primarily for animal feed and industrial uses and it is partioned as follow; about 35% for human nutrient requirement, about 65% for animal feed (Kuşaksız, 2010). But sweet corn is only produced for human consumption as either a fresh or processed product. Beside it is possible to use its green part for feeding. Standard sweet corn differs from field or dent corn by a mutation at the sugary locus. The sweet corn mutation causes the endosperm of the seed to accumulate about two times more sugar than field corn (Schultheis, 1998).

Although it was informed that sweet corn has been grown in Turkey since 1930 (Eşiyok et al., 2004), there is no any statistical record about its production. Sweet corn has been grown in Bursa and its surrounding (Turgut, 2000). However sweet corn can be easily grown in corn production areas. Eşiyok et al. (2004) indicated that sweet corn production can easily be grown in the west and the south regions dominated by the Mediterranean climatical conditions of Turkey. Therefore, we need new varieties with high yield and better quality adapted to the different environments.

Selection is a widely used and successful method in plant breeding. Response to selection depends on many factors such as the interrelationship of the characters. Plant breeders work with some yield components related to yield in the selection programs and it is very important to determine relative importance of such characters contributing to grain yield directly or indirectly. Correlation and path coefficient analyses can assist to determine certain characters to be used in the improvement of the complex character such as yield (Joshi, 2005). Information about correlative characters in sweet corn has been still very limited. The direct and indirect effects of specific yield components could be precisely identified and applied in breeding programs of sweet corn by determining of inter-relationship among fresh grain yield and yield components.

Aim of this study was to determine yield components through correlation and path coefficient analyses so they would be utilized by the breeders to develop new sweet corn varieties with high yielding capacity.

## MATERIALS AND METHODS

The trial was arranged in the Randomized Completely Block Design with three replicates by using 8 sweet corn varieties under drop irrigated conditions during the 2009 and the 2010 main growing seasons at the Ege University placed in Bornova-Izmir. Bornova is located (Latitude 38°28' and Longitude 27°13') in the west part of Turkey near Aegean Sea with altitude of 27 m and dominated by the Mediterranean climatical conditions. The experimental area has a heavy soil structure with clay-silt soil at 0-20 cm depth and clay-loamy structure at 20-40 cm depth. Standard agronomical practices were applied in both years. Each plot had three rows 3 m length with spacing 70 cm between rows and 20 cm between plants (Turgut, 2000). Two seeds were planted in each hill and then thinned to one plant to have a final plant density of 71420 plants $ha^{-1}$. Harvest was done at the end of the milk stage of seed for each variety. Observations and measurements were done for seven characters (fresh grain yield, plant height, fresh ear weight, ear diameter, ear length, row number per ear, grain number per row) from the center row of the each plot. Analysis of variance was performed for each character and LSD (least significant difference) test was applied to compare the differences (Steel and Torrie, 1980). Since genotype x year interaction was not significant for fresh grain yield, mean values were obtained over two years. Phenotypic correlations were calculated and considering fresh grain yield as a dependent variable, path coefficient analyses were carried out according to the procedures given by Dewey and Lu (1959).

## RESULTS AND DISCUSSION

The analysis of variance showed that there was no significant interaction between the years and genotypes for all characters except for grain number per row. Besides differences among the hybrid varieties were significant for all measured traits in the p≤ 0.01 level. Mean values of the genotypes over 2-years are presented in Table 1. These results indicated that sufficient genetic variation among the hybrid genotypes was present.

**Table 1.** Mean values of the hybrid sweet corn varieties combined over two years

| Varieties | Fresh grain yield kg ha$^{-1}$ | Plant height cm | Fresh ear weight g. ear$^{-1}$ | Ear diameter cm | Ear length cm | Row number ear$^{-1}$ | Grain number row$^{-1}$ |
|---|---|---|---|---|---|---|---|
| El Toro | 13589 a | 186.6 a | 282.9 a | 4.6 ab | 22.3 ab | 15.9 cd | 40.4 ab |
| Merkür | 12350 abc | 180.0 ab | 258.4 abc | 4.3 ab | 23.1 a | 16.0 cd | 40.1 ab |
| Martha | 10132 de | 149.7 c | 231.5 cd | 4.8 a | 20.8 cd | 17.7 b | 40.3 ab |
| Harvest Gold | 10372 cde | 177.1 ab | 224.9 d | 4.1 b | 21.5 bc | 19.2 a | 40.8 ab |
| Vega | 9614 e | 151.5 c | 220.5 d | 4.2 b | 21.6 bc | 15.0 d | 41.1 a |
| Merit | 10960 b-e | 181.5 ab | 231.9 cd | 4.5 ab | 19.8 d | 16.5 bc | 36.7 c |
| Sunshine | 12734 ab | 171.8 b | 268.9 ab | 4.5 ab | 21.6 bc | 17.3 b | 40.7 ab |
| Erica | 12244 a-d | 178.8 ab | 243.9 bcd | 4.6 ab | 20.5 cd | 16.6 bc | 38.3 bc |
| LSD (5%) | 2152 | 14.2 | 28.0 | 0.57 | 1.34 | 1.16 | 2.74 |
| Mean square | 33290.6 | 145.5 | 564.7 | 0.23 | 1.29 | 0.96 | 5.40 |

**Table 2.** Correlation coefficients among the traits of eight sweet corn varieties

| | Fresh Grain yield | Plant height | Fresh Ear weight | Ear diameter | Ear length | Row number ear$^{-1}$ |
|---|---|---|---|---|---|---|
| Plant Height | 0.566** | | | | | |
| Fresh Ear weight | 0.813** | 0.595** | | | | |
| Ear diameter | 0.010 | 0.036 | 0.196 | | | |
| Ear length | 0.463* | 0.208 | 0.470* | -0.069 | - | |
| Row number ear$^{-1}$ | -0.027 | 0.108 | -0.060 | -0.056 | -0.083 | - |
| Grain number row$^{-1}$ | -0.021 | -0.056 | 0.261 | 0.101 | 0.578** | 0.177 |

The correlation coefficients among the traits are given in Table 2. The r values indicated that fresh ear weight had the highest positive correlation (r=0.813**) with fresh grain yield. This finding confirmed the result of Bozokalfa and Eşiyok (2006) who reported positive and highly significant correlation (r=0.84**) between these two characters. Plant height and ear length also had significant positive correlations with fresh grain yield (r=0.566** and r=0.463* respectively). Fresh ear weight which is used as a main yield parameter by many researchers (Eltahir and Ghizan, 2003; Bozokalfa et al., 2004; Öktem, 2008) had also positive and significant correlations with plant height and ear length. These results are in agreement with the finding of Eltahir and Ghizan (2003). However Öktem (2008) reported a positive but insignificant correlation coefficient between plant height and fresh ear weight.

Grain yield, which is accepted as a major economic character in corn and due to its complex nature depends on all other yield components. Change in anyone of the components could ultimately disturb the balance. Hence, these correlated traits have to be analyzed for their action namely their direct effect on the grain yield and also by the indirect effects over other yield components on the grain yield (Kumar et al., 2011). Therefore, the total correlations were partitioned in to the direct and the indirect effects with path analysis by using grain yield per plant as dependent variable. The results are presented in Table 3.

**Table 3.** Direct and indirect effects of different traits on fresh grain yield of sweet corn

| Traits | Direct effects | Indirect effects | | | | | | Correlation coefficient |
|---|---|---|---|---|---|---|---|---|
| | | Plant height | Fresh ear weight | Ear diameter | Ear length | Row number ear$^{-1}$ | Grain number row$^{-1}$ | |
| Plant height | -0.009 | - | 0.450 | -0.001 | 0.082 | 0.014 | 0.026 | 0.566** |
| Ear weight | 0.756 | -0.006 | - | 0.007 | 0.187 | -0.010 | -0.008 | 0.813** |
| Ear diameter | 0.034 | -0.0003 | 0.148 | - | -0.027 | -0.007 | -0.048 | 0.010 |
| Ear length | 0.398 | -0.002 | 0.356 | -0.002 | - | -0.011 | -0.275 | 0.463* |
| Row num. ear$^{-1}$ | 0.138 | -0.001 | -0.045 | -0.001 | -0.032 | - | -0.084 | -0.027 |
| Grain num. row$^{-1}$ | -0.476 | 0.0005 | 0.197 | 0.003 | -0.114 | 0.230 | - | -0.021 |

Path analysis revealed that maximum positive contribution on fresh grain yield could be made by fresh ear weight (69.5%), row number per ear (45.5%) and ear length (38.1%). Besides most of the traits exhibited indirect positive influence on grain yield through ear weight and ear length. Thus these traits could be used more confidently as the selection criteria in the fresh grain yield improvement of sweet corn. Similar results in support of our results were given by other researchers Öktem (2008) and Hefny (2011). Some researchers reported negative direct effects of ear diameter on grain yield (Qadir and Saleem, 1991; Selvaraj and Nagarajan, 2011; Hefny, 2011). On the other hand, some others Eleweanya et al. (2005) and Öktem (2008) contrarily stated the positive and high direct effects of ear diameter. In this study this trait had positive but low influence (%12.84) on fresh grain yield. Although grain number per row had negative direct effect (51%) on fresh grain yield, it had indirectly positive effect via ear weight and row number per ear. Same result was also reported for dent corn by Selvaraj and Nagarajan (2011). Plant height was positively correlated (r=0.566**) with fresh grain yield but it had negative and low direct effect on grain yield. Its positive correlation with fresh grain yield could be mainly due to its indirect effect (76.9%) over fresh ear weight.

In conclusion, ear weight could be used as a selection criterion due to its highly positive direct effect on fresh grain yield also indirect effects on all other characters. Also row number per ear and ear length could be considered as yield component as selection criteria in sweet corn breeding.

## ACKNOWLEDGEMENTS

I'm grateful to Ege University and Faculty of Agriculture for supporting this study as the project number 2009 ZRF 025.

## LITERATURE CITED

Bozokalfa, M.K., D. Esiyok, 2006. Morphological variability of some sweet corn genotypes. (in turkish with english abstract). Ege Üniv. Ziraat Fak. Derg. 43(2):1-12.

Bozokalfa, M.K., D. Esiyok, A. Ugur. 2004. Determination of Yield Quality and Plant Characteristic of some sweet corn (*Zea mays* L. var. *saccharata*) varieties as main and second crop in ege region. (in turkish with english abstract). Ege Üniv. Ziraat Fak. Derg. 41(1):11-19.

Dewey, D.R., K.H. Lu, 1959. A correlation and path analysis of components of crested wheat grass seed production. Agron . J. 51: 515-518.

Eleweanya, N. P., M.I. Uguru, E.E. Eneobong, P.I. Okocha, 2005. Correlation and path coefficient analyses of grain yield related characters in maize (*Zea mays L.*) under umudike conditions of south eastern Nigeria. Journal of Agriculture, Food, Environment and Extension. 4(1): 24-28.

Eltahir S.A., Ghizan, B.S., 2003. Response of two cycles of phenotypic mass selection and heritability on two tropical sweet corn (*Zea mays* L. *saccharata*) populations. Asian Journal of Plant Science, 2(1): 65-70.

Esiyok, D., K. Bozokalfa, A. Ugur. 2004. Determination of yield quality and some plant characteristic of some sweet corn (*Zea mays* L. var. *saccharata*) varieties in different locations (in turkish with english abstract). Ege Üniv. Ziraat Fak. Derg. 41(1):1-9.

Hefny, M., 2011. Genetic parameters and path analysis of yield and its components in corn inbred lines (*Zea mays* L.) at different sowing days. Asian Journal of Crop Science 3(3):106-117.

Joshi, B.K, 2005. Correlation, regression and path coefficient analyses for some yield components in common and Tartary buckwheat in Nepal. Fagopyrum 22: 77-82.

Kumar, T.S., Reddy, D.M.R.K.H., Sudhakar, P., 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.

Kusaksiz, T., 2010. Adaptability of some new maize (*Zea mays* L.) cultivars for silage production as main crop in Mediterranean environment. Turk. J. of Field Crops 15(2): 193-197.

Oktem, A., 2008. Determination of selection criterions for sweet corn using path coefficient analyses. Cereal Research Communications 36(4): 561–570.

Qadir, A., M. Saleem, 1991. Correlation and path coefficient analysis in maize (*Zea mays* L.) Pak. J. Agri. Sci., 28(4): 395-398.

Schultheis, J.R., 1998. Sweet Corn Production. Published by North Carolina Cooperative Extension Service. (Access date: 15.09.2011, http://www.ces.ncsu.edu/depts/hort/hil/hil-13.html)

Selvaraj, C.I., P. Nagarajan, 2011. Interrelationship and path-coefficient studies for qualitative traits, grain yield and other yield attributes among maize (*Zea mays* L.). Int. J. Plant Breed. Genet. 5(3): 209-223.

Steel, RGD., J.H. Torrie, 1980. Principles and Procedures of Statistics. Second Edition, Mc. Graw-Hill Book Company Inc., New York.

Turgut, I. 2000. Effects of plant populations and nitrogen doses on fresh ear yield and yield components of sweet corn (*Zea mays saccharata* Sturt.) grown under Bursa conditions (in Turkish with English abstract). Turk. J. Agric. For. 24: 341–347.